Atlantic Billfish Fishery Management Plan Amendment

Chapter 3
Rebuilding and Maintaining Atlantic Billfish Fisheries

3.1 Management Under National Standard 1: The MSY Control Rule

National standard 1 (NS1) of the Magnuson-Stevens Act requires that conservation and management measures "prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the U.S. fishing industry." The Magnuson-Stevens Act also requires that FMPs specify "objective and measurable criteria" for identifying when a fishery is overfished (Section 303(a)(10)) and, for overfished fisheries, that NMFS prepare an FMP "to end overfishing in the fishery and to rebuild affected stocks of fish" (Section (304(e)(3)(a)). For all species managed under the Magnuson-Stevens Act, there are two parameters to consider in developing overfishing definitions for fish stocks, and these are defined as "status determination criteria" in the final rule for the national standard guidelines (63 FR 24211; May 1, 1998). These parameters are used to trigger designation of "overfishing" or "overfished." As presented in Figure 3.1.1, the two status determination criteria, are: (1) the maximum fishing mortality rate threshold (MFMT); and (2) the minimum stock size threshold (MSST). A technical guideline on the use of precautionary approaches to implementing NS1 (Restrepo *et al.*, 1998) was used to develop the MSY control rule for this FMP amendment.

The national standard guidelines (NSGs) state that the status determination criteria are to be used for the purpose of determining which fisheries are in need of action to "end overfishing" and to "rebuild affected stocks of fish." To that end, the status determination criteria must provide a measure of the rate of fishing mortality, as well as a measure pertaining to the size of the stock. If only a MFMT were identified, only fisheries requiring action to end overfishing could be identified, and it would not be possible to determine which stocks require rebuilding actions. Conversely, if only a MSST were specified, it would be possible to determine which fisheries require action to rebuild overfished stocks, but it would not be possible to determine which fisheries require action to end overfishing.

The parameters used to list Atlantic blue marlin and Atlantic white marlin as overfished in the September 1997, Report to Congress were based on the 1995 "Our Living Oceans." Since that report, further guidance on the definition of overfishing has been given in a final rule that revises guidelines for Magnuson-Stevens Act NS1. Under the NSGs, to overfish means to fish at a rate or level of fishing mortality that jeopardizes a fishery's capacity to produce maximum sustainable yield (MSY) on a continuing basis. The directive to have stock sizes that could produce maximum sustainable yield on a continuing basis is a fundamental element of NS1. Overfishing, therefore, occurs whenever a stock or stock complex is subjected to a rate or level that jeopardizes the capacity of a stock or stock complex to produce maximum sustainable yield on a continuing basis. Overfished is used to describe any stock or stock complex whose size is sufficiently small that a change in management practices is required in order to achieve an appropriate level and rate of rebuilding.

3.1.1 Life History Characteristics of Atlantic Billfish

Blue marlin are found throughout tropical and subtropical waters of the Atlantic Ocean and adjacent seas, ranging from Canada to Argentina on the western side of the Atlantic, and from the Azores to South Africa on the eastern side (SCRS, 1997). Their latitudinal range is from 45° N to 35°S, with a possible center of distribution in the Caribbean Sea. An epipelagic and oceanic species, blue marlin are usually found in oceanic blue water environments, with surface water temperatures ranging from 22° to 31°C (Nakamura, 1985). Blue marlin have an extensive geographical range, and are generally considered to be a rare and solitary species relative to the schooling scombrids (SCRS, 1997). In the western Atlantic, there are two main seasonal concentrations: January to April in the southwest Atlantic from 5° to 30°S, and June to October in the northwest Atlantic (Nakamura, 1985). Along the western Atlantic, seasonal movements have been noted between the U.S. east coast and the Caribbean Sea, and between the east coast and the Gulf of Mexico (Scott *et al.*, 1990). In the eastern Atlantic, where blue marlin are less abundant, they occur mostly off the east coast of Africa between 25°N and 25°S (Nakamura, 1985).

White marlin are found throughout tropical and temperate waters of the Atlantic Ocean and adjacent seas. Their range is almost identical to that of blue marlin, although they seem to be less abundant in the east Atlantic. Unlike blue marlin, white marlin occur only in the Atlantic Ocean (SCRS, 1997). The latitudinal range of white marlin covers almost the entire Atlantic Ocean, from 45°N to 45°S in the western Atlantic and 45°N to 35°S in the eastern Atlantic. A pelagic and oceanic species, they are usually found in deep blue water (over 100 m), with surface water temperatures over 22°C, and salinities of 35 to 37 ppt. Distributions vary seasonally, with white marlin reaching the higher latitudes in both the northern and the southern hemispheres only during the respective warm seasons.

Sailfish, the most common Atlantic Istiophorid, and longbill spearfish, the rarest Atlantic Istiophorid, have circumtropical distributions. Although sailfish have high concentrations in coastal waters, they are also found in oceanic waters (SCRS, 1997). The latitudinal range of sailfish is approximately 40°N in the western North Atlantic, 50°N in the eastern Atlantic, 40°S in the western South Atlantic, and 32°S in the eastern South Atlantic. In the western Atlantic, sailfish concentrate in the Caribbean Sea, the Gulf of Mexico, and around the West Indies and Florida coastal waters. Distribution of west Atlantic sailfish and longbill spearfish around the east coast of the United States appears to be influenced by meteorological conditions. During the summer, west Atlantic sailfish and longbill spearfish move northward along with the extension of warm weather. With the beginning of cold weather and northerly winds, west Atlantic sailfish and longbill spearfish move southward to congregate off the Florida coast. Seasonal movements of sailfish have been noted off the coast of Africa, where the sailfish concentrations have been also associated with oceanic fronts (Nakamura, 1985).

All Atlantic billfishes exhibit rapid growth in the first 1-2 years of life, with blue marlin reaching about 75 inches in 500 days (1.4 years). Maximum lengths and weights are about 175 inches and 1,300 lbs for blue marlin, 90 inches 180 lbs for white marlin, and 85 inches and 120 lbs for sailfish.

Blue marlin are believed to live at least 30 years, white marlin about 25-30 years, and sailfish 15-20 years, although most of the Atlantic sailfish caught in fisheries are thought to be less than 4 years old. The sizes at which females first reach maturity are about 100-130 lbs for blue marlin, 45 lbs for white marlin and 30 - 40 lbs for sailfish. Corresponding sizes at which billfish first become vulnerable to fishing are generally similar to or somewhat lower than the sizes at maturity: approximately 100 lbs for blue marlin, 30 lbs for white marlin and 25 lbs for sailfish. All species appear to have protracted spawning seasons during summer with evidence of spawning over widely distributed areas in the tropics. Fecundity is high. For example, blue marlin have been estimated to have up to 10.9 million eggs and may spawn more than once per year, although not necessarily every year.

Sparse distributions and stock trajectories that have not exhibited pronounced or sudden upturns over the last 25 years suggest that billfish are not capable of rapid repopulation and may not be able to recover quickly from a depleted state. Conversely, billfish have a moderately long lifespan, which means that the stocks consist of several age classes, a condition that serves as a buffer against adverse environmental conditions and that confers some degree of stability on the stocks. Billfish are also at a high trophic level, which makes the species less vulnerable to short term fluctuations in environmental conditions. Additional life history information is provided in Chapter 4.

3.1.2 Maximum Fishing Mortality Threshold (MFMT)

The MFMT is one of the two required status criteria components. Guidance set forth in the final rule on Magnuson-Stevens Act provisions and NSGs calls for the MFMT to be set at the fishing mortality rate defined by the chosen MSY control rule (defined in Section 600.310(c)(1)(ii) as the harvest strategy which, if implemented, would be expected to result in long-term average catch approximating maximum sustainable yield). If this level of fishing mortality is exceeded, then overfishing would be occurring (Figure 3.1.1). Overfishing criteria must take into account the life history characteristics of the species under consideration (Section 3.1.1, and 4.3) in the selection of appropriate status determination metrics. The life history parameters used to estimate MSST are summarized in Table 3.1.1.

The MFMT for Atlantic billfish is set at F_{MSY}, the level of fishing mortality associated with production of maximum sustainable yield. This level of fishing mortality, which would trigger a designation of "overfishing," is most consistent with ICCAT, and in consideration of the international management of Atlantic billfish resources, is deemed to be the most appropriate level for the MFMT status determination criteria. The 1997 SCRS report indicates that the relative fishing mortality (F_{1995}/F_{MSY}) in the Atlantic Ocean for blue marlin was 2.87 (80% CI = 1.45 to 3.41); in the north Atlantic the relative blue marlin fishing mortality was 1.21 (80 % CI = 0.96 - 1.56). The relative fishing mortality level for Atlantic white marlin was 1.96 (80% CI = 1.33 - 2.91) under the total Atlantic stock scenario, and 2.37 in the north Atlantic (80% CI = 1.60 - 8.41). The relative fishing mortality ($F_{1991-95}/F_{MSY}$) in the western Atlantic for sailfish was approximately 1.4 (no confidence interval was calculated). Therefore, overfishing of blue marlin, white marlin and west Atlantic sailfish is occurring under the definition for MFMT used in for the Atlantic billfish FMP amendment.

3.1.3 Minimum Stock Size Threshold (MSST)

The MSST is the second component of the status determination criteria. The final NSGs state that MSST should be set at whichever of the following is greater: $0.5B_{MSY}$ or the minimum stock size at which rebuilding to the maximum sustainable yield level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold. Biomass level is a function of fishing mortality and the biology of the species and environmental conditions. By altering fishing mortality rates, stocks can be managed to promote a biomass level that will support a sustainable fishery, or prevent the stock from falling to an unsustainably low biomass level. Therefore, selection of the level of MSST should be made in the context of the FMP's objective to rebuild overfished fisheries and control fishing mortality so as to ensure the long-term sustainability of the stocks and promote stock recovery to the level of maximum sustainable yield.

B_{MSY} is the biomass level that is associated with maintaining maximum sustainable yield on a long-term basis. The relative biomass (B_{year}/B_{MSY}) is the biomass in the year being measured as a proportion of the biomass necessary to support maximum sustainable yield. Atlantic billfish biomass levels in the Atlantic Ocean provided in the 1997 SCRS report, based on the most recent

stock assessments, indicate that Atlantic blue marlin relative biomass (B_{1996} /B_{MSY}) was 0.236 (north Atlantic = 0.608), and 0.226 for white marlin (north Atlantic = 0.321). The relative biomass ($B_{1992/96}$ /B_{MSY}) for sailfish/spearfish in the western Atlantic was approximately 0.62.

Goodyear (1998) used simulation modeling to estimate MSST based on biological characteristics of Atlantic blue marlin. The level of natural mortality, the magnitude of the stochastic variation in first-year survival, and the form of the stock-recruitment model (Beverton-Holt or Ricker stock-recruitment models) were important predictors of MSST. Results indicated that MSST should typically be no less than 25 percent below the spawning stock associated with B_{MSY} when fished at $F_{MSY.}$ Goodyear suggested that for Atlantic blue marlin, MSST should be set at a range of $0.9B_{MSY}$ to $0.95B_{MSY}$.

The MSST for Atlantic billfish is set at $(1\text{-}M)B_{MSY}$, where M is the instantaneous natural mortality rate. The formulation of MSST using $(1\text{-}M)B_{MSY}$ is a proxy for the minimum stock size at which rebuilding to the maximum sustainable yield level would be expected to occur within 10 years if the stock or stock complex were exploited at MFMT. Quantitative data necessary to calculate natural mortality rates are not available; however, reasonable values can be estimated based on life history parameters and age structure of the population (see Goodyear, 1998). Estimates of natural mortality rates range from 0.05 to 0.15 for Atlantic blue marlin, and from 0.1 to 0.2 for Atlantic white marlin, while sailfish estimates are higher, ranging from 0.2 to 0.3. The draft FMP utilized M values near the lower-end of the precautionary range; however, based on further analyses, the MSST values selected for the final Atlantic billfish FMP amendment are:

Atlantic blue marlin -	$0.9B_{MSY}$
Atlantic white marlin -	$0.85B_{MSY}$
West Atlantic sailfish -	$0.75B_{MSY}$.

The level of MSST selected for Atlantic blue marlin ($0.9B_{MSY}$) also falls within the mid-point range recommended by Goodyear's analyses. Precautionary actions in the determination of optimum yield (OY) (Section 3.3) also support the selected MSST levels. The most recent estimates of relative blue and white marlin relative biomass levels (SCRS, 1997) fall below the minimum relative stock biomass limit, even if the MSST was set at the lowest possible level ($0.5B_{MSY}$). West Atlantic sailfish are also considered to be overfished based on the biomass parameter of the overfishing status determination criteria. The paucity of information on longbill spearfish and their rare occurrence prevent an accurate assessment of the status of their stocks using the status criteria; however several precautionary measures are considered in this FMP Amendment to reduce fishing mortality.

Figure 3.1.1. Graphical illustration of status determination criteria and rebuilding terms (explanation of components of the graphs are found in Section 3.2.4) .

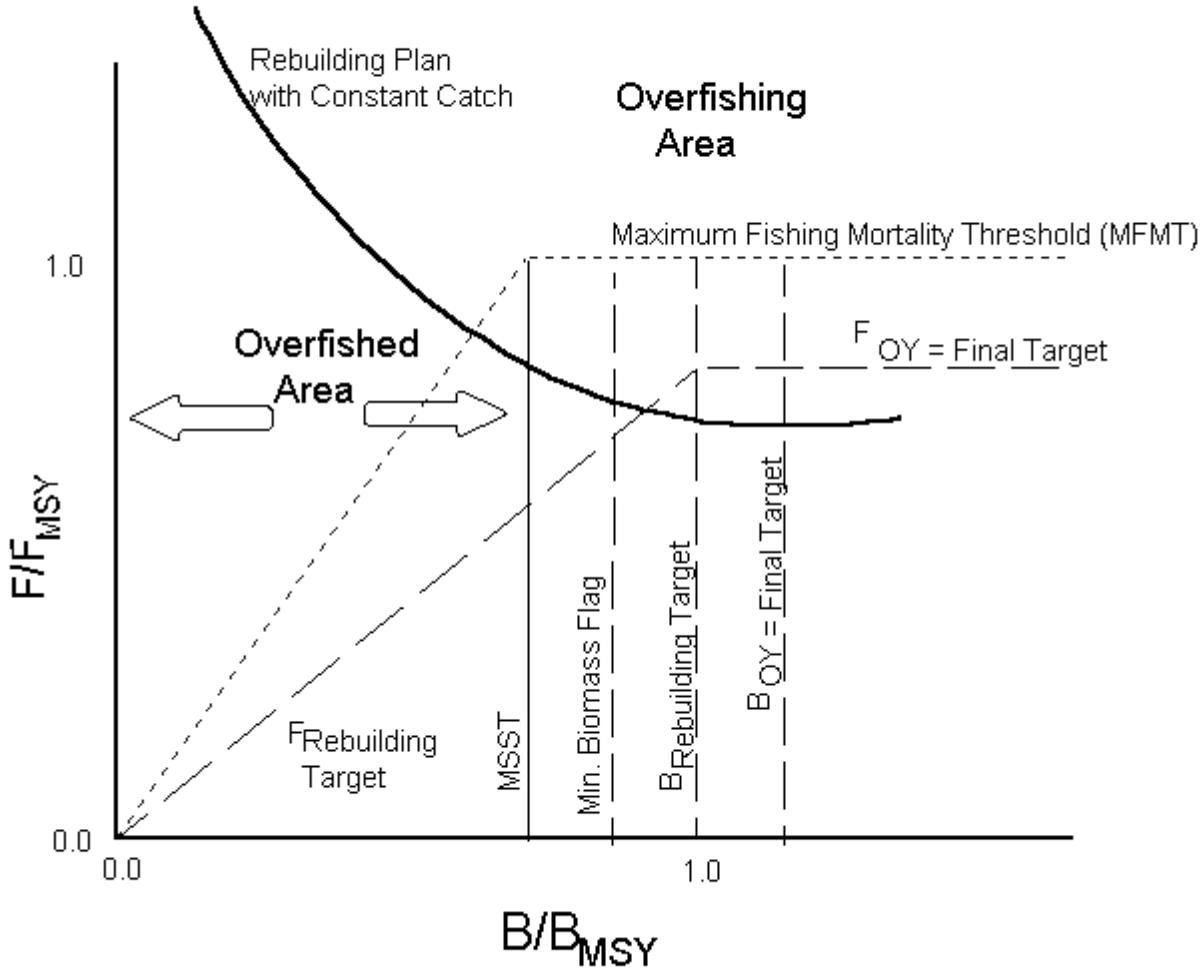


Table 3.1.1. Summary of life history parameters used in development of the maximum fishing mortality threshold. All sizes are lower-jaw-fork length in inches (see Section 3.4.1).

	Blue Marlin		White Marlin		Sailfish	
	Female	Male	Female	Male	Female	Male
Size-at-maturity	76	69	61	55	62	48
Regulatory Minimum Size Limit	96		66		57	
Maximum Size	175		90		85	
Maximum Age (years)	30		25-30		15-20	
Size at recruitment	70		57		50	
Mean Size at Capture	101.5		66.7		64.3	
Median Size at Capture	100.2		66.1		64.2	

3.2 Overfished Stocks: Managing for Recovery

The level of allowable fishing mortality is one of the few parameters that fishery managers utilize to initiate efforts in rebuilding an overfished fishery. While stocks may be managed with a goal of achieving a certain biomass level, biomass cannot be managed directly as it is primarily a function of the biology of the species and environmental conditions. Adding to the complexity of management of Atlantic billfish resources is the level of mortality attributable to the United States, relative to other ICCAT member countries/entities. Between 1990 to 1996, the United States accounted for, on average, 5.2 percent of Atlantic blue marlin, 5.8 percent of Atlantic white marlin mortality (recreational landings and longline discards from commercial catches) in the total Atlantic Ocean, and 6.6 percent of the sailfish mortality in the western Atlantic (Table 2.1.6).

In 1997, ICCAT adopted the first binding recommendation for Atlantic billfish by requiring the reduction of blue marlin and white marlin landings by at least 25 percent from 1996 levels, starting in 1998, to be accomplished by the end of 1999. Atlantic-wide landings of marlin in 2000 will be held to 1999 levels as a result of the 1998 ICCAT recommendation. The 25 percent reduction in blue and white marlin landings will result in reductions of U.S. recreational landings of approximately 21,000 pounds; more importantly, this recommendation will result in nearly a 3.4 million pound decrease in Atlantic-wide marlin landings from 1996 levels by other ICCAT member countries. However, given current levels of Atlantic-wide fishing mortality and stock biomass, even assuming considering full compliance with the required 25 percent reductions in landings by the end of 1999 for Atlantic blue marlin and white marlin recommended by ICCAT, blue marlin landings would have to be reduced an additional 42.3 percent just to reach the 1996 replacement yield (1,920 mt); further reductions of 18.6 percent would be required for white marlin to achieve the 1996 replacement yield of 921 mt (Table 3.2.1). Clearly, rebuilding will be not be achieved within the constraints of the Magnuson-Stevens Act under the landing reductions resulting from the 1997 ICCAT recommendation. The SCRS will develop rebuilding scenarios that may require further reductions in landings, as appropriate, following the 2000 for stock assessments for Atlantic marlins and the 2001 assessment for west Atlantic sailfish.

Managers consider a range of alternatives in deciding how to rebuild overfished stocks. As discussed below, the alternatives range from cessation of all fishing on overfished stocks to maintaining or increasing the level of fishing mortality on the stocks in question. However, some of these alternatives that are not feasible because they do not support requirements of the Magnuson-Stevens Act to rebuild overfished stocks. The options that do not support requirements of the Magnuson-Stevens Act were rejected, and several options for managing fishing mortality within in the range of feasible alternatives were analyzed further for each overfished species.

Four basic approaches cover the full range of alternatives for overfished stocks:

Prohibit all harvest (i.e., all sources of fishing mortality) of the overfished stocks - This alternative would lead to the fastest rebuilding of overfished stocks because it would drive the

fishing mortality rate to zero, thus eliminating fishing pressure on the stock. However, this alternative would impose severe restrictions on fishery participants, in both directed and incidental fisheries. At this time, this approach is inconsistent with the objectives of the FMP. This alternative is also impractical from a management viewpoint because it would require prohibition of all gear capable of catching the overfished species in the wide-ranging area inhabited by the species, by all vessels from various countries whose fleets interact with Atlantic billfish. Given its practical shortcomings and adverse social and economic impacts, this approach is rejected.

Increase the harvest to maximum sustainable yield levels - The Magnuson-Stevens Act and this FMP amendment establish the maximum sustainable yield level as the highest acceptable harvest level for any species under management. Based on this guidance, managers can allow harvest at fishing mortality rates up to the maximum sustainable yield level. This approach must be rejected for overfished stocks, however, because it would not meet requirements to rebuild overfished stocks. It should be noted that all overfished Atlantic billfish are currently fished at a rate above the maximum sustainable yield level (Section 3.1), thus, this alternative was not selected.

Status Quo - This approach would adopt the status quo harvest levels to serve as a rebuilding plan. Atlantic billfish are being fished at rates in excess of the level required to produce maximum sustainable yield. This option does not meet requirements to halt overfishing and rebuild overfished stocks; therefore, this approach is rejected.

Allow harvest in accordance with the rebuilding program - This approach is the only feasible alternative for overfished Atlantic billfish. In order to meet the FMP amendment objective of rebuilding overfished stocks, fishing mortality must be reduced from the status quo level for overfished stocks. To guide the rebuilding process, managers must select a biomass target that will achieve rebuilding and a recovery period during which that rebuilding will take place. Using the biomass target (Section 3.2.1) and recovery period (Section 3.2.2) as guides, managers can select fishing mortality rates for the recovery period that will rebuild the stocks in the selected time period and allow management to proceed to the second phase, ongoing management of healthy stocks (Section 3.3).

After a biomass target and preferred recovery period have been selected, managers must determine which management tools should be used to meet the FMP objectives and requirements of the law (Section 3.4). Domestically, all sources of fishing mortality should be evaluated in consideration of various management alternatives. Billfish fishing mortality occurs as a result of intentional and unintentional interaction with recreational and commercial fishing gear and fishing activities. Foreign pelagic longline fisheries account for nearly 95 percent of the mortality of Atlantic billfish in the Atlantic Ocean (Table 2.1.6). Domestically, the bycatch of Atlantic billfish in pelagic longline gear constitutes the majority of the currently reported annual billfish mortalities provided by the United States to ICCAT, accounting for approximately 85 percent of Atlantic blue marlin, 95 percent of Atlantic white marlin and 98 percent of west Atlantic sailfish mortalities; the remaining percentages are attributed to recreational billfish

landings (Table 2.1.4). U.S.-flagged commercial fishing vessels are prohibited from landing and selling Atlantic billfish from the management unit. However, some of these fishermen catch billfish unintentionally (generally with pelagic longline gear) while fishing for other species (e.g., swordfish and tunas). Billfish caught by commercial fishing equipment are considered bycatch and must be released, whether dead or alive, and reported in the mandatory logbook system. It is not known how many fish that are released alive survive the capture event, although it has been noted that billfish can survive 12 hours or more on longline gear (Berkeley and Edwards, 1997).

Recreational fishing can result in either intentional mortality by retention of an Atlantic billfish, or unintentional mortality as a result of the capture and release process, whether from directed recreational billfish angling or incidental catch in association with other recreational fishing efforts. Although recreational release rates have been estimated to be in excess of 90 percent, without studies on post-release mortality, it is not possible to accurately estimate the total fishing mortality caused by recreational fishermen. It is important to note, however, that recreational anglers have voluntarily increased release rates of billfish as part of the general conservation ethic of this user-group. In fact retention of a billfish is becoming increasingly "socially unacceptable."

The Magnuson-Stevens Act, in section 304(e), gives detailed requirements for actions that must be undertaken in response to the overfished designation (Section 1.9), including reduction of fishing mortality to a rate or level below the MFMT to meet the required rate and level of rebuilding. Reducing fishing mortality is a critical component in the rebuilding strategy of any overfished stock; however, control of fishing mortality of Atlantic billfish resources is problematic due to the wide migratory ranges of these species, the international nature of the billfish fishery, and small share of fishing mortality attributed to the United States. It is the objective of the Atlantic billfish FMP amendment to minimize, to the extent practicable, all of the unintentional sources of fishing mortality while limiting the intentional fishing mortality to a level that will help achieve rebuilding of overfished stocks, and maximize net economic benefits to the nation by managing the fisheries for the long-term optimum yield. Management measures used to address unintentional fishing mortality of billfish are included in the HMS FMP, except for the allowance of retention of any billfish caught on rod and reel. The rebuilding biomass target, recovery periods, and levels of fishing mortality rates are three parameters that NMFS will use to guide the rebuilding process. The interrelationship of the thresholds (Section 3.2.1), targets and recovery period is illustrated in Figure 3.1.1.

3.2.1 Rebuilding Biomass Target (B_{target})

The rebuilding of an overfished stock necessitates the definition of a biomass level beyond which the stock is no longer considered overfished. Because current biomass levels are very low, this biomass level becomes a target biomass in the rebuilding plan. The biomass target (B_{target}) is a level of stock abundance where maximum harvesting of the resources can be sustained on a continual basis. This value would be at a biomass level greater than the MSST used in the overfished status determination criteria (Figure 3.1.1). As discussed in the NSGs, rebuilding actions should do more than merely assure that the stock reaches the target level; rather, the goal

should be to restore the stock's capacity to remain at or above that level (optimum yield) on a continuing basis, consistent with the stock's natural variability. The NSGs provide further guidance in stating that maximum sustainable yield is the key to the Magnuson-Stevens Act, with maximum sustainable yield constituting the upper limit on optimum yield. Maximum sustainable yield is therefore the *initial target* (emphasis added) for rebuilding an overfished stock. The rebuilding biomass target is applicable only during the rebuilding phase of the fishery resource.

The rebuilding biomass target for overfished Atlantic billfish is set at the biomass level associated with maximum sustainable yield. When Atlantic blue marlin, Atlantic white marlin and west Atlantic sailfish attain this level (B_{MSY}), stocks would be considered as recovered from a status of overfished. The final NSGs indicate that the Magnuson-Stevens Act, in section 3(28)(C), implies strongly that the maximum sustainable yield stock size is at least an initial target for rebuilding. It is also noted that the optimum yield stock size will be equal to or greater than maximum sustainable yield stock size. A precautionary management strategy, after B_{target} has been achieved, is discussed in Section 3.3, which includes an ultimate biomass target level associated with optimum yield. The rationale behind a target biomass level higher than that associated with maximum sustainable yield lies in the objective of the Atlantic Billfish FMP and this FMP amendment to maintain the highest availability of billfish to the U.S. recreational fishery. Management measures associated with maintaining maximum sustainable yield will maximize potential landings, which may be inappropriate for a recreational species where the objective is to maximize encounter (catch) rates. However, use of a biomass target of B_{MSY} as an initial rebuilding target is consistent with ICCAT management objectives for Atlantic billfish resources.

3.2.2 Rebuilding Management Strategies

Once a stock has been determined to be overfished, as is the case for Atlantic blue marlin and Atlantic white marlin, as well as west Atlantic sailfish under the status determination criteria (Section 3.1; Figure 3.1.1), management strategies must be formulated to ensure that rebuilding is accomplished within the constraints of the Magnuson-Stevens Act. A key element in considering rebuilding management alternatives for Atlantic billfishes is the international level of harvest relative to that attributable to the United States, and the levels of harvest required to rebuild within a 10-year period.

A matrix is presented in Table 3.2.1 summarizing Atlantic-wide and U.S. landings of Atlantic blue and white marlin, and projected impacts of the 25 percent reduction required by ICCAT relative to what further reductions would be required to rebuild these overfished stocks. Atlantic-wide harvest levels would have to be reduced from 1999 ICCAT recommended levels (3,182 mt for Atlantic blue marlin, and 1,078 mt for Atlantic white marlin) by an additional 1,382 mt for Atlantic blue marlin and 278 mt for Atlantic white marlin to rebuild stocks within 10 years (F of Table 3.2.1). If all U.S. billfish-related mortalities were eliminated from both recreational and commercial sectors, based on 1996 levels, the overall contribution by the United States to the additional 1,382 mt of Atlantic blue marlin and 278 mt Atlantic white marlin

required to allow for Atlantic-wide rebuilding in 10 years would be only 231.4 mt and 70.9 mt, respectively (G in Table 3.2.1). Therefore, Atlantic blue marlin and Atlantic white marlin stocks can only be rebuilt through international cooperation. The SCRS has indicated that if live marlin are released from commercial gear by all ICCAT member countries, and if there is little or no post-release mortality, rebuilding of marlin stocks could be completed within 10 years. Although unilateral actions by the United States will not provide sufficient reductions in mortality to allow rebuilding of these overfished Atlantic billfish stocks, management actions provided in the Atlantic billfish FMP amendment can be utilized as a framework for international conservation actions, and a basis for U.S. strategy at ICCAT.

The Atlantic Billfish FMP amendment must also consider other regulatory actions, including reduction of bycatch levels to comply with Magnuson-Stevens Act directives. In addition, the 1997 ICCAT effectively established a limit for allowable U.S. landings of 26.2 mt of Atlantic blue marlin and 2.48 mt of Atlantic white marlin, based on currently reported 1996 recreational landings. This action will require consideration of alternatives to enhance monitoring of the recreational fishery to ensure full compliance with ICCAT-recommended harvest levels. The ICCAT recommendation did not include reduction in west Atlantic sailfish landings, although ICCAT has designated west Atlantic sailfish as fully exploited. Current Atlantic billfish regulations were implemented under the authority of the Magnuson-Stevens Act, which limited fishing-related activities shoreward of the outer boundary of the EEZ. The Atlantic billfish FMP amendment extends regulations for U.S. vessels throughout the Atlantic by expanding the definition of the management unit, and implementing regulatory actions under the dual authority of the Magnuson-Stevens Act and ATCA, thereby increasing the effectiveness of U.S. regulations. These management measures are addressed in Sections 3.4 to 3.8.

3.2.3 Recovery Periods

Rebuilding trajectories should be designed to make consistent and reasonably rapid progress towards recovery, enabling stocks to be rebuilt within the time constraints of the Magnuson-Stevens Act. The final NSGs provide guidance on the statutory requirement that a rebuilding program be "as short as possible." The starting point in developing a rebuilding program is the length of time in which a stock could be rebuilt in the absence of fishing mortality on that stock. If that period is less than 10 years, the factors in section 304(e)(4)A)(i) may be used to adjust the rebuilding period up to 10 years, including the biology of the fish, needs of fishing communities, recommendations by international organizations in which the United States participates (e.g., ICCAT) and interactions of the overfished stock of fish with the marine ecosystem. A longer rebuilding schedule than the no-mortality period can be justified if the stock cannot be rebuilt within 10 years because of the limitations listed in Section 304(e)(4)(A)(ii), which include the biology of the stock of fish, other environmental conditions, or management measures under an international agreement in which the United States participates dictate otherwise. The NSGs provide further guidance on the length of time that can be used for rebuilding. The time frame is defined as the time to recover at no-mortality plus one mean generation time (or equivalent period based on the species life history characteristics). Rebuilding must show consistent

progress and should include explicit milestones expressed in terms of measurable improvement of the stock with respect to its defined target levels.

Recovery periods for Atlantic billfish are constrained by their life history strategies and international management through ICCAT. Another critical constraint is the very low share of the United States (approximately 5 percent; Table 2.1.6) to the overall Atlantic-wide billfish mortality. Atlantic billfish are relatively long-lived, fast growing, and highly fecund. They achieve large sizes, with wide ranges of distribution in the Atlantic Ocean. These life history characteristics are consistent with a species that could recover from an overfished state in approximately 10 years, given greatly reduced fishing mortalities. Although Atlantic billfish are managed throughout the Atlantic Ocean by ICCAT, there are also countries landing these species in the Atlantic Ocean that are not members and are not directly bound by ICCAT recommendations, further exacerbating the over-exploited nature of these stocks. Nevertheless, even if these countries did abide by ICCAT recommendations, the current management recommendations to reduce landings by at least 25 percent from 1996 levels for Atlantic blue marlin and Atlantic white marlin would not allow for stock recovery (Table 3.2.1).

After a biomass target has been determined, various management measures must be used to limit fishing mortality to levels that allow for an increase in biomass, and thus rebuild the overfished stock within the time constraints established by the recovery period. During rebuilding, an F_{target} would be established to ensure continuous progress in stock abundance. The fishing mortality target (Figure 3.1.1), as with the biomass target, would be applicable only during the rebuilding phase of the fishery resource. Each recovery period, therefore, has a concomitant level of F_{target} to ensure that rebuilding can occur within the specified time frame.

A summary of the final action, rejected options, and associated allowable landings and years to recover to B_{MSY} is provided for Atlantic blue marlin, Atlantic white marlin, and west Atlantic sailfish in Table 3.2.2. The National Environmental Policy Act (NEPA) requires managers to examine the full range of alternatives when considering implementation of new management measures, including some measures that may violate requirements of other laws.

Final Action: Establish the foundation to develop an international 10-year rebuilding program for Atlantic billfish.

This final action establishes the foundation that can be used in negotiations with ICCAT to develop a 10 year Rebuilding Program for overfished billfish species, including targets for recovery, fishing mortality rate limits, and explicit interim milestones expressed in terms of measurable improvements of the stock. If successful, international conservation and management measures will be adopted by ICCAT to rebuild these stocks. The United States would then implement the ICCAT Rebuilding Program through quotas and/or increased minimum sizes and retention limits in the domestic fishery.

Historically, the United States has been a leader in conservation of Atlantic billfish, and has taken actions (e.g., the 1988 Atlantic billfish FMP) to show our willingness to take the critical steps necessary to conserve these stocks. This fact has been a primary negotiation tool at ICCAT, and it is questionable whether the recent ICCAT actions (i.e., the 1997 and 1998 ICCAT recommendations) would have been possible without the support of the United States. The United States sponsored a recommendation at the 1998 ICCAT meeting that directs the SCRS to develop stock-recovery scenarios, where appropriate, following stock assessments for Atlantic blue and white marlin in the year 2000, and stock assessments for west Atlantic sailfish in 2001.

Ecological Impacts

Non-equilibrium stock-production modeling has shown that under a scenario of no fishing mortality in the Atlantic Ocean, Atlantic blue marlin and Atlantic white marlin could recover to the rebuilding biomass targets (B_{MSY}) in approximately 8 years and 6 years, respectively (Figures 3.2.1 and 3.2.2). Although it is possible for Atlantic blue marlin and Atlantic white marlin stocks to rebuild in less than 10 years at zero fishing, the NSGs indicate that the factors in section 304(e)(4)(A)(i) may be used to adjust the rebuilding period up to 10 years, including recommendations by international organizations in which the United States participates (e.g., ICCAT). The United States is bound by ATCA to implement ICCAT-approved actions, including those for Atlantic billfish, once the actions are accepted by the United States. Rebuilding of Atlantic billfishes may take up to 10 years, indeed, even longer due to potential non-compliance by member nations, or fishing activities of non-ICCAT members who do not report billfish mortality. The Billfish AP supported the 10-year rebuilding time frame; however, there was concern that the model used to generate stock recovery projections may have been overly optimistic, noting that under alternative analytical methodologies, it may take longer than 10 years to recover overfished billfish resources.

To rebuild Atlantic blue marlin within the 10-year time frame, an F_{target} that would provide landings of approximately 1,800 mt ww for the Atlantic would be required (Figure 3.2.3). The F_{target} for white marlin would be set at a level to allow landings of approximately 800 mt ww in the Atlantic (Figure 3.2.4). These target catch levels are much lower than the most recently reported catch levels (1996) of 4,243 mt ww and 1,438 mt ww of Atlantic blue marlin and Atlantic white marlin, respectively. Target catch levels for 1999 (after the 25 percent recommended catch reductions), are also above the 10-year rebuilding target levels, with 3,182 mt for blue marlin and 1,078 mt for white marlin. Continued landings in excess of the replacement yield would be expected to result in continued stock decline (SCRS, 1998).

Commercial dead discards and recreational billfish landings by the United States account for only an estimated five percent of the reported mortality of Atlantic billfish stocks, meaning that fishing fleets from other countries are responsible for the remainder of the catch. Consequently, the fishing practices of other nations must be changed if Atlantic billfish stocks are to be rebuilt. The method of achieving any of the management alternatives will vary depending on the strategy employed by the U.S. delegation to ICCAT to influence international policy development and implementation. The results, of course, will depend on the outcome of multi-level negotiations

within the international forum. The following management measures could be a part of the United States' international strategy:

1. Catch restrictions: Quotas, percentage reductions in landings, observer coverage;

2. Time and Area Closures: Similar to domestic options, if they are identified, to protect critical areas;

3. Release of live billfish by commercial longline vessels;

4. Release of all billfish by longline vessels;

5. Size Limits: Similar to domestic options to protect critical life stages and/or reduce retention of landings; and

6. Independent Observers: Would observe ICCAT fishing nations' activities.

A 10-year rebuilding time frame could be achieved by allowing retention of all dead marlin and requiring the release of only a percentage of live billfish. There are five ICCAT countries/entities responsible for a majority of the Atlantic blue marlin (66.9 percent) and white marlin (59.9 percent) landings in the Atlantic: Brazil, Chinese Taipei, Japan, United States and Venezuela. However, Atlantic blue and white marlin landings make up only a small percentage, by weight, of the overall landings of ICCAT species (tunas, swordfish, marlins and sailfish) of these countries/entities: Brazil - 0.45 percent; China-Taiwan - 2.03 percent; Japan - 3.64 percent; United States - 2.07 percent; and Venezuela - 1.08 percent. The United States requires all billfish caught on commercial gear to be released (whether dead or alive). In addition, it has been observed from U.S. pelagic longline sets that 74.4 percent of blue marlin and 68.8 percent of white marlin are released alive from pelagic longline sets.

The current projected 1999 landing levels (no more than 75 percent of reported 1996 landings) are above the level of landings that would provide for rebuilding within 10 years. However, if countries are allowed to retain all dead marlin (25.6 percent for blue marlin, and 31.2 percent for white marlin; D of Table 3.2.3; these percentages are based on observer data from the U.S. pelagic longline fleet), then with the release of a portion of the live fish (blue marlin - 58.4 percent, and white marlin - 37.5 percent; J of Table 3.2.3), the rebuilding target landing levels can be achieved © and K of Table 2.5.7). This rebuilding strategy would reduce an ICCAT member's Atlantic blue marlin landings by 43.4 percent and 25.8 percent for Atlantic white marlin. An example of applying these reductions is provided in Table 3.2.4 the country/entity with the highest Atlantic blue marlin landings (Japan) and Atlantic white marlin landings (Chinese Taipei). As stocks recover, this release strategy would be modified to ensure sustainability of Atlantic billfish stock levels.

The Magnuson-Stevens Act and NSG provide guidance for managers to accommodate the limitations imposed by being a member of an international body whose management

recommendations may not readily conform to a ten-year rebuilding time frame. Under this action, the United States will adopt a rebuilding program for Atlantic billfishes as recommended by ICCAT. However, implementation of this alternative will depend on a thorough analysis of the ICCAT Rebuilding Program to ensure that it includes a specified recovery period, biomass targets, fishing mortality rate limits, and explicit interim milestones expressed in terms of measurable improvement of the stock. Each of these components is necessary to support the objectives of this FMP and the intent of the Magnuson-Stevens Act.

Economic Impacts

Rebuilding overfished Atlantic billfish resources will require international cooperation to reduce landings to levels that will allow rebuilding to occur; by accounting for only 5 percent of Atlantic-wide billfish mortalities, reductions by the United States alone are insufficient to meet target levels (Atlantic blue marlin - 1,800 mt; Atlantic white marlin - 800 mt). The United States initiated efforts to reduce fishing mortality through the 1988 Atlantic Billfish FMP by requiring commercial fisheries to release all billfish (whether alive or dead), and instituted size limits to reduce recreational landings. From 1989 to 1996, the commercial pelagic longline fishery has annually lost approximately $665,000 in gross revenues as a result of billfish dead discards (Section 2.1.4). Annual recreational landings of Atlantic blue marlin have been reduced since 1988 by approximately 73 percent relative to pre-Atlantic billfish FMP levels (1980 to 1988); annual white marlin recreational landings have declined by approximately 90 percent over the same time frame. Additional reductions in mortality by U.S. commercial entities and recreational entities will be required to achieve rebuilding within the 10-year time frame. However the economic impacts will not likely be of the magnitude of that experienced as a result of the 1988 FMP. An analysis of economic impacts on recreational anglers of an ICCAT Rebuilding Program can not be conducted until the rebuilding strategy is developed. This FMP amendment utilizes increases in minimum size limits to reduce landings in order to comply with the 1997 ICCAT recommendation, and discussion of the economic impacts of this final action are provided in Section 3.4.1.

The international rebuilding plan will have some economic consequences (positive as well as negative), mainly outside the United States, differing only in degree depending on the option considered. Negative short-term economic effects might be experienced by the commercial fleets if their catches of marketable species decrease (e.g., due to time-area closures). However, commercial fleets may experience long-term benefits as more fishery resources are available. Short-term loss in revenue will be mitigated in the long-term by increases in the biomass of Atlantic billfish stocks, thus allowing for significantly increased catch and landings at high, yet sustainable, levels in the future.

Social Impacts

It is anticipated that the social impacts of a 10-year rebuilding period will be minimal. This conclusion is based on input from the Billfish AP, and surveys of recreational billfish anglers'

attitude towards conservation (e.g., Fisher and Ditton, 1992; Ditton and Clark 1994), which supported methods utilized by this FMP amendment to reduce mortality levels, including increases in size limits, instituting gear modifications to increase post-survival rates, and an Atlantic billfish bycatch reduction strategy to reduce bycatch mortality.

Conclusion

This is the final action. An international recovery plan for overfished billfish species is the most effective alternative for meeting the conservation objectives of NS 1, while taking into account the impacts on fishing communities. Under this action the United States would implement the catch levels and other management measures recommended by ICCAT as its rebuilding program. NMFS will work with ICCAT members to develop a rebuilding program that meets the standards of the Magnuson-Stevens Act and the NSGs, including an appropriate rebuilding time period, targets for recovery, fishing mortality rate limits, and explicit interim milestones for recovery expressed in terms of measurable improvement of the stock.

However, implementation of this alternative would depend on an analysis of any rebuilding program adopted by ICCAT, including targets for recovery, fishing mortality rate limits, and explicit interim milestones expressed in terms of measurable improvement of the stock, to ensure that the international plan supports the objectives of the FMP amendment and the intent of the Magnuson-Stevens Act.

Rejected Option: Recovery to rebuilding biomass target with no fishing mortality.

Ecological Impacts

Rebuilding with no U.S. fishing mortality would mean that no recreational landings or pelagic longlining would be allowable. Commercial restrictions would be required to eliminate fishing mortality associated with bycatch in commercial gear. Under this alternative of no fishing mortality (F = 0), given the life history characteristics of Atlantic billfish and the current levels of stock abundance, it would take approximately 5 to 8 years for blue marlin to recover to the rebuilding biomass target (Figure 3.2.1). Atlantic white marlin would take approximately 4 to 6 years to recover to the rebuilding biomass target (Figure 3.2.2) at zero fishing mortality. Given the international magnitude of the Atlantic billfish fishery (approximately 95 percent from non-U.S. sources), this alternative is not likely to provide a practical method to recover overfished Atlantic billfish stocks.

Economic and Social Impacts

This alternative would necessitate the implementation of the most restrictive landing limitations of all alternatives concerned, resulting in the greatest economic impact to businesses associated with the Atlantic billfish fishery. Prohibiting landings by recreational anglers would have an immediate negative impact on the revenues associated with a reduced recreational billfish angling effort, including charter vessels, fishing tackle, tournament participation, and

local revenues associated with billfish tournaments. If the $32,281 figure of each landed billfish is used from Fisher and Ditton (1992), then the potential economic impact of prohibiting billfish landings (i.e., the projected impact of not landing the estimated cap of 320 billfish for 1999 - Section 3.4.2) would be $10.3 million in reduced expenditures. The long-term impacts may result in an increase in net benefits as stocks are rebuilt and recreational encounters become more frequent.

Atlantic blue and white marlin landings make up only a small percentage of the overall ICCAT species (tunas, swordfish, marlins and sailfish) catch of these countries: Brazil - 0.45 percent; Chinese Taipei - 2.03 percent; Japan - 3.64 percent; United States - 2.07 percent; and Venezuela - 1.08 percent. Therefore, eliminating foreign commercial fishing operations to recover Atlantic billfish stocks would severely impact the economic viability of foreign fishing fleets.

Conclusion

It is not likely that other ICCAT members will be willing to eliminate all retention of Atlantic billfish, although the SCRS has suggested release of all live marlins caught by pelagic longline gear (retaining all those dead upon retrieval) could rebuild Atlantic-wide stocks in less than 10 years. NMFS did not select the alternative of zero fishing mortality because of the economic and social impacts associated with elimination of fishing mortality.

Rejected Option: Recovery to biomass rebuilding target within the time to recover at no fishing mortality plus one mean generation.

Ecological Impacts

This alternative, which is outlined in the final NSGs, may be applied in circumstances where the biology of the animal or recommendations by an international organization prevent the stock from rebuilding in 10 years, even at zero fishing. In such cases, the NSGs for implementation of NS1 state that the rebuilding period may be adjusted upwards of 10 years to the time period that would allow recovery with no-mortality, plus one mean generation time for the species. Generation time is based on the definition provided by Goodyear (1995), which incorporates estimates of mean fecundity-at-age for females, the average number of females per recruit alive at each age in the absence of fishing, and natural mortality rate (Restrepo *et al.*, 1998). These data are not readily available for blue marlin or white marlin; however, approximations of generation times can be made based on available information on life history characteristics: blue marlin - 12 years; and white marlin - 7 years. These values would provide a recovery to the biomass rebuilding target of 17 to 20 years for blue marlin, and 11 to 13 years for white marlin.

Economic and Social Impacts

A longer rebuilding time period would mitigate many of the immediate economic and social impacts that would be experienced under a shorter-term rebuilding scenario by allowing more

fish to be landed on an annual basis than would be required by a more stringent plan. However, the long term net benefits associated with a recovered stock (e.g., more frequent encounter rates leading to increased recreational angler satisfaction and revenues) would be delayed under this alternative.

Conclusion

The best currently available scientific information indicates that Atlantic blue and white marlin could recover in less than 10 years under zero fishing mortality. Therefore, the guidelines for implementation of NS1 suggest that this alternative is not appropriate for billfishes. Although the Billfish AP supported a 10-year recovery period, some AP members expressed concern that the model used to generate stock recovery projections (Figures 3.2.1 to 3.2.4) may have been overly optimistic. However, model projections and estimates for recovery periods in this amendment are based on the best currently available science, therefore the alternative to recover at no fishing mortality plus one mean generation was not selected as a preferred alternative.

3.2.4 Target Control Rule

Atlantic blue marlin, Atlantic white marlin and west Atlantic sailfish stocks currently violate both the overfished and overfishing thresholds (MFMT and MSST, respectively), thereby triggering the need for a rebuilding plan in accordance with the Magnuson-Stevens Act. Figure 3.1.1 is a graphical presentation of the major elements of a rebuilding program. The X-axis represents the stock's biomass; the Y-axis represents the fishing mortality rate for the stock. The two darkest lines on the graph represent the status determination criteria (the minimum stock size threshold (MSST) and maximum fishing mortality threshold (MFMT)). The minimum stock size threshold is a vertical line. When the biomass level falls below that line, the stock is considered overfished and must be rebuilt. The maximum fishing mortality threshold is a horizontal line. When the fishing mortality rate goes above this level, overfishing is occurring and the stock must be rebuilt. Under the MFMT and MSST status criteria defined in the FMP amendment, Atlantic blue marlin, Atlantic white marlin and west Atlantic sailfish stocks are overfished, and are experiencing overfishing by fishing activity in the Atlantic Ocean.

There are several other important lines in Figure 3.1.1. The dotted line labeled "B_{target}" represents the biomass that managers are trying to achieve during a rebuilding program. In the case of Atlantic billfish, B_{target} is B_{MSY}. The three dashed lines represent: (1) the minimum biomass flag; (2) the fishing mortality rate that will produce the optimum yield (F_{OY}); and (3) the biomass at optimum yield (B_{OY}). When a fishery is healthy, managers will try to set the fishing mortality rate so that it produces the optimum yield. Biomass can be expected to fluctuate over time, due to changes in environmental conditions, recruitment to the stock, or other variables; however, when biomass drops to the level of the minimum biomass flag, managers should be aware of the decline and may want to consider implementing measures to prevent the stock from falling further to the minimum stock size threshold. Thus, the minimum biomass flag serves as a warning to consider remedial action before implementation of a formal rebuilding program is required. The relationship between the threshold parameters and those utilized in developing a rebuilding strategy and optimum yield (Section 3.2 and 3.3) is illustrated in Figure 3.2.5. The curved line shows the impact of rebuilding under a constant catch, as discussed under the recovery periods in the previous section (e.g., 1,800 mt per year over a 10 year period to recover Atlantic blue marlin stocks).

Figure 3.2.1. Relative biomass trajectory projections at F=0 for blue marlin in the Atlantic Ocean (from Jones 1997).

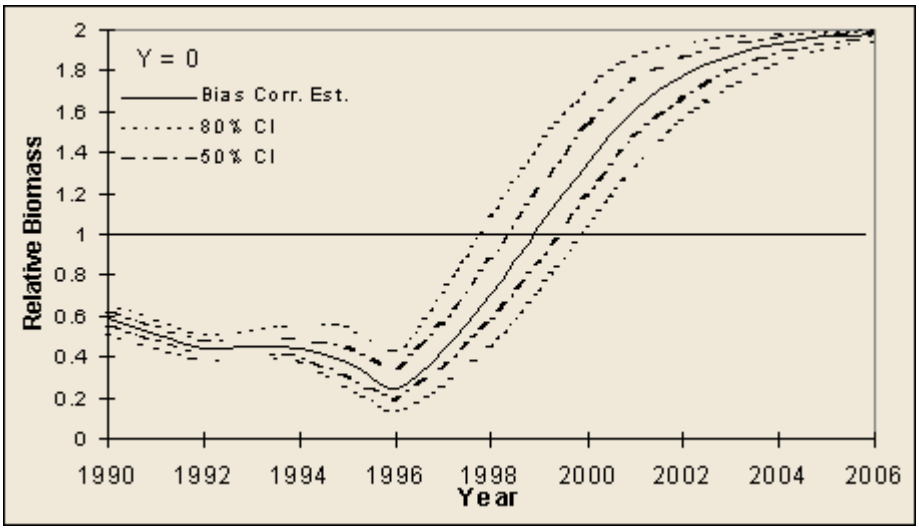


Figure 3.2.2. Relative biomass trajectory projections at F=0 for white marlin in the Atlantic Ocean (from Jones 1997).

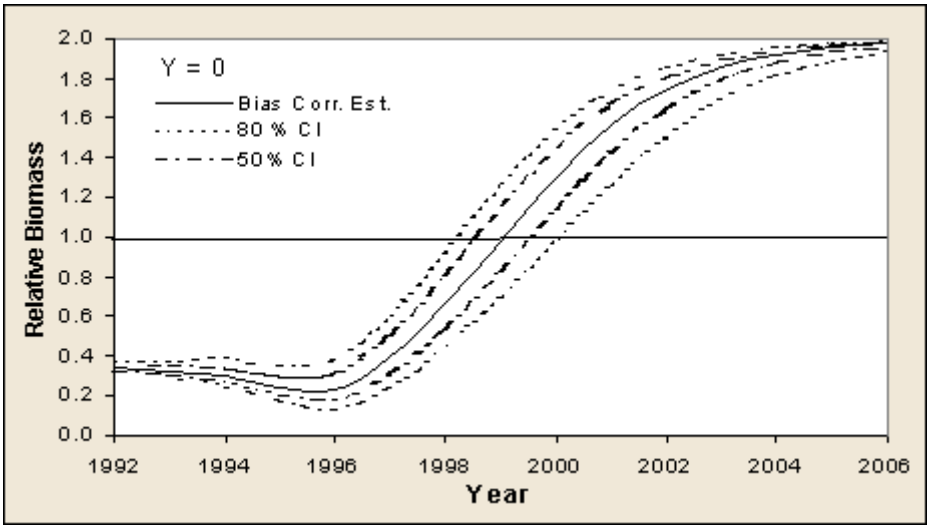


Figure 3.2.3. Relative biomass trajectory projections at a level of fishing that would allow recovery in ten years (F=1,800 mt) for blue marlin in the Atlantic Ocean (from Jones 1997).

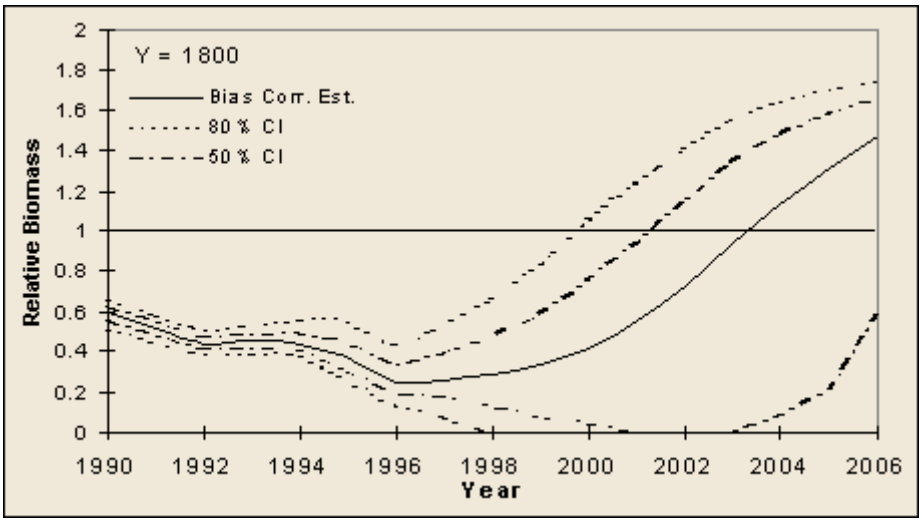


Figure 3.2.4. Relative biomass trajectory projections at a level of fishing that would allow recovery in ten years (F=800 mt) for white marlin in the Atlantic Ocean (from Jones 1997).

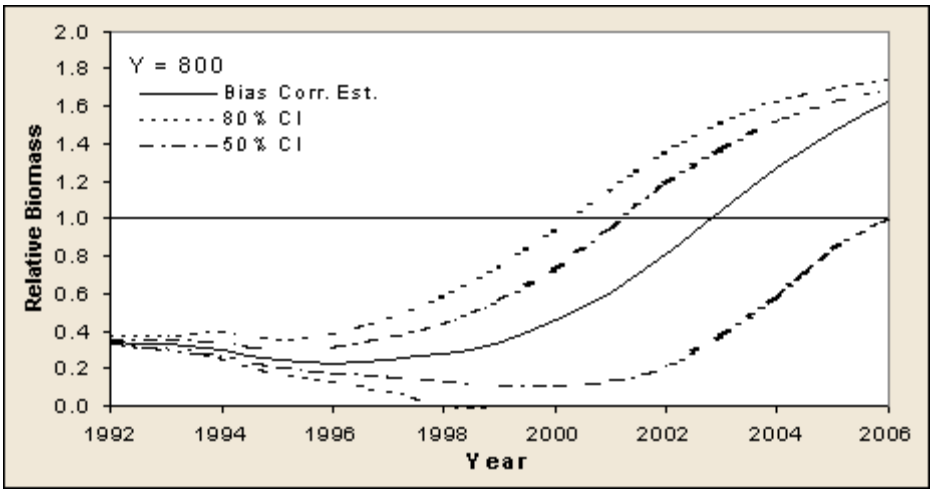


Figure 3.2.5. Flow chart illustrating relationships between status determination criteria thresholds with rebuilding (Section 3.2) and optimum yield (Section 3.3) metrics.

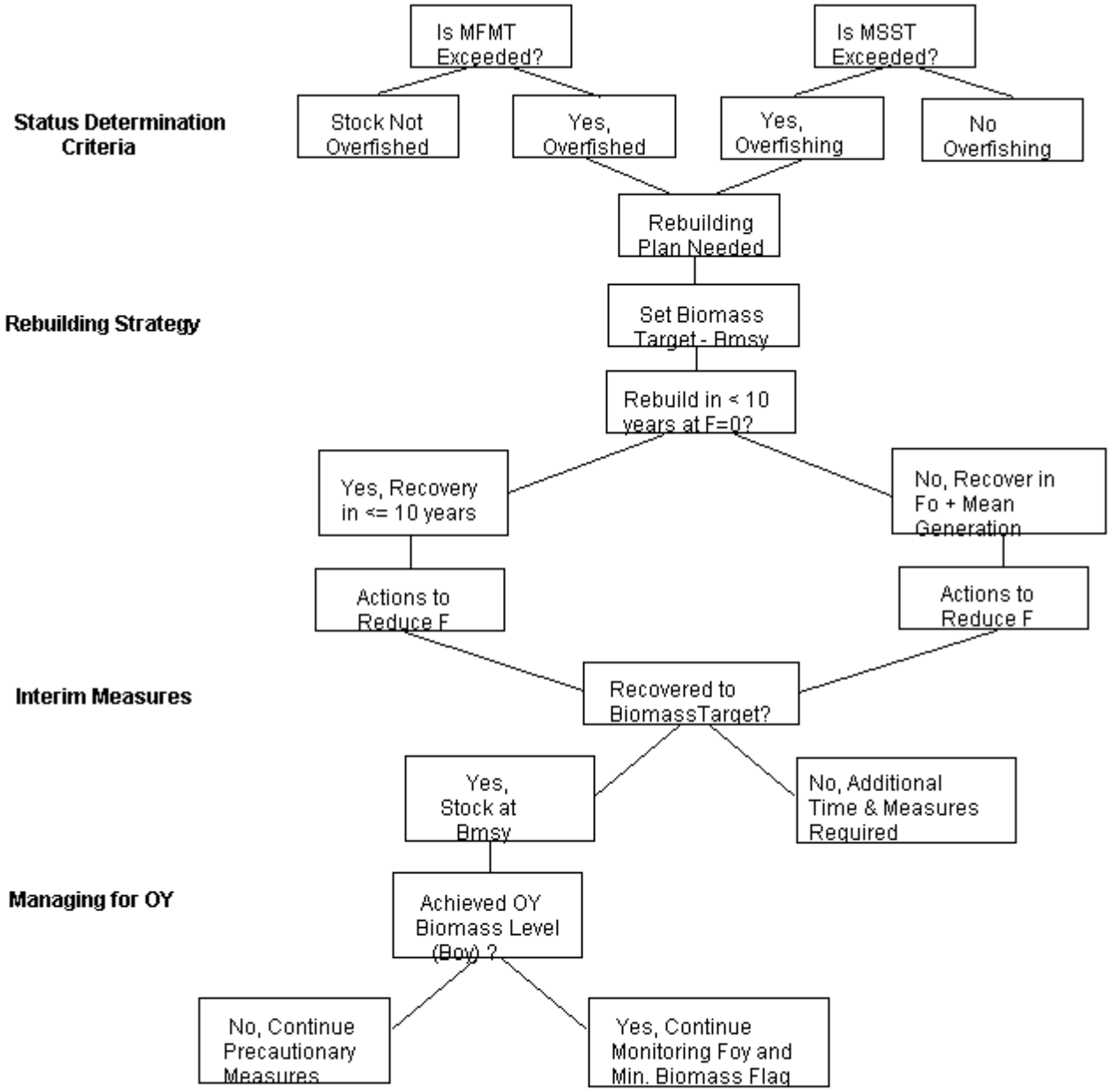


Table 3.2.1. Matrix of relative U.S. impact on Atlantic marlin fisheries and Atlantic-wide landings to allow rebuilding overfished stocks.

		Atlantic Blue Marlin	Atlantic White Marlin	West Atlantic Sailfish
Total Atlantic				
A	1996 Catch in Atlantic	4,439 mt	1,508 mt	886 mt
B	1996 Landings in Atlantic (A - U.S. longline dead discards)	4,243 mt	1,438 mt	814 mt
C	1996 Replacement Yield	1,920 mt	921 mt	~600 mt
D	1997 ICCAT Recommendation: 25 Percent Reduction from 1996 to be Fully Implemented in 1999 (75% of B)	3,182 mt	1,078 mt	N/A
E	Allowable Catches to Necessary to Achieve Rebuilding in 10 Years	1,800 mt	800 mt	unknown
F	Further Reductions to 1997 Recommendation Required to Achieve Rebuilding in 10 years (D- E)	1,382 mt	331 mt	unknown
United States				
G	1996 U.S. Billfish Mortality Reported to ICCAT: Commercial Dead Discards + Recreational Landings	231.4 mt	70.9 mt	72.8 mt
H	1996 U.S. Reported Recreational Landings	34.9 mt	3.3 mt	1.2 mt
I	Percent of 1996 Atlantic-wide Catch Attributable to U.S. Recreational Landings (H/B*100)	1.1%	0.31%	0.15%
I	1999 Allowable U.S. Landings Under 1997 ICCAT Recommendation (25 % of H)	26.2 mt	2.48 mt	N/A

Table 3.2.2. Recovery trajectory alternatives relative to time to rebuild to B_{MSY}.

	Atlantic Blue Marlin		Atlantic White Marlin	
	Allowable Landings	Time to B_{msy}	Allowable Landings	Time to B_{msy}
10 years	1,800 mt	10 years	800 mt	10 years
F = 0	0	5-8 years	0	4-6 years
F = 0 plus 1 mean generation time	1,920 mt	17-20 years	921 mt	11-13 years
Defer to international body (75% of 1996 landings in total Atlantic)	3,182 mt	no rebuilding	1,078 mt	no rebuilding

Table 3.2.3. Potential Atlantic blue marlin and Atlantic white marlin ICCAT rebuilding strategy.

		Blue Marlin	White Marlin
A	1996 Landings in Atlantic	4,243 mt	1,438 mt
B	Projected 1999 Landings based on 1997 ICCAT recommendation (0.75*A)	3,182 mt	1,078 mt
C	Atlantic-wide allowable landings to rebuild in 10 years	1,800 mt	800 mt
D	Percent Fish Dead on longline[1] (see Table 4.7.2)	25.6%	31.2%
E	Amount of 1999 catch that is dead at gear retrieval (D*B)[1]	815 mt	336 mt
F	Amount of 1999 catch that is alive at gear retrieval ((100-D)*B)[1]	2,367 mt	742 mt
G	Amount of live fish that can be retained to allow for rebuilding in 10 years[2] (C-E)	985 mt	464 mt
H	Percent of live fish retained (G/F*100)	41.6%	62.5%
I	Amount of live fish released (F-G)	1,382 mt	278
J	Percent of live fish released (I/F*100)	58.4%	37.5%
K	Total live and dead fish retained (E+G)	1,800 mt	800 mt
L	Percent reduction of 1999 level due to discard of live fish to reduce fishing mortality to rebuild in 10 years (I/B*100)	43.4%	25.8%

[1]Percent of dead billfish on longline gear are based on numbers reported by observers on U.S. pelagic longline vessels.

[2]The amount of live fish that can be kept is based on the assumption that all dead fish are retained (E), and subtracting this amount from the number of fish that can be kept to allow for rebuilding in 10 years (C), gives the mt of live fish that can be retained and still achieve rebuilding (i.e., C - E). These numbers are based on live/dead ratios observed for the U.S. pelagic longline fishery.

Table 3.2.4. Example of catch reduction for an ICCAT country/entity under the potential rebuilding strategy.

	Blue Marlin	White Marlin
ICCAT member country with largest share of Atlantic landings	Japan	Chinese-Taipei
1996 Atlantic-wide landings by that country	1,668 mt	566 mt
Percentage of 1996 Atlantic-wide marlin landings	39.3%	39.4%
Percent of country's ICCAT landings that are attributed to marlin	3.64%	2.03%
Projected 1999 landings based on 1997 ICCAT recommendation	1,251 mt	425 mt
Amount of fish that are dead at retrieval (%)[1]	320.2 mt (25.6%)	132.4 mt (31.2%)
Amount of fish that are alive at retrieval (%)[2]	930.7 mt (74.4%)	292 mt (68.8%)
Amount of live fish at retrieval that are retained (%)	387.2 mt (41.6%)[3]	182.5 mt (62.5%)
Amount of live fish at retrieval that are discarded alive (%)	543.5 mt (58.4%)[4]	109.5 mt (37.5%)
Total catch retained	707.4 mt	314.9 mt
Percent reduction in catch	43.4%	25.8%

[1]Percent of dead billfish on pelagic longline gear is based on numbers reported by observers on U.S. pelagic longline vessels.

[2]Percent of live fish on pelagic longline gears is based on numbers reported by observers on U.S. pelagic longline vessels.

[3]Percentage is from Table 2.5.7, line H

[4]Percentage is from Table 2.5.7, line J

3.3 Healthy Stocks: Managing for Optimum Yield

The Magnuson-Stevens Act is clear in its requirement to prevent overfishing. Once stocks are rebuilt, it is also critical to set precautionary thresholds to avoid overfishing. Consistent with the NSGs for NS1, target reference points, such as optimum yield , should be set to avoid exceeding limit reference points (i.e., MFMT and MSST). NMFS should use precautionary thresholds to prevent thresholds from being exceeded. Therefore, both precautionary measures of biomass and fishing mortality should be more restrictive than the overfishing status determination criteria (Figure 3.1.1). Target reference points are not absolute ceilings, but rather a desired result. The criteria used to set target reference points should be risk averse, so that greater uncertainty regarding the status or productive capacity of a stock or stock complex corresponds to greater caution in setting target catch levels.

In defining the status determination criteria (Section 3.1), fishing mortality and biomass limit reference points were set to trigger designation of overfishing (MFMT) or overfished (MSST). Similarly, there are fishing mortality and biomass components that NMFS can utilize in the establishment of optimum yield target reference points. In addition to the fishing mortality and minimum biomass levels, a biomass target should be identified after a fishery has been rebuilt to the level established in Section 3.2.1 (i.e., B_{MSY}). Choice of the biomass target level must be made in consideration of the objective of this FMP amendment, i.e., to maximize the availability of billfish for recreational anglers. To that end, a biomass level that increases encounter rates should be selected rather than a level associated with maintaining the maximum available for landing. The precautionary measures are:

B_{OY}: biomass target after the stock has been rebuilt to B_{MSY};

F_{OY}: the level of fishing to ensure that the maximum fishing mortality rate threshold (MFMT) is not exceeded, and will allow the stock to continue to build toward B_{OY}

Minimum biomass flag: a level of biomass indicative of approaching an overfished state (MSST).

3.3.1 Biomass Target After Rebuilding (B_{OY})

The Billfish Advisory Panel, during review of status determination criteria and rebuilding strategies, indicated that a level of 1.2 B_{MSY} was the appropriate level for the biomass target during rebuilding of overfished Atlantic billfish resources. Although a B_{target} level of B_{MSY} was selected for the final Atlantic billfish FMP amendment because it was deemed to be a biomass target level more consistent with national standard NSGs, as well as ICCAT goals, a 1.3 B_{MSY} target for biomass associated with optimum yield after rebuilding has been completed is reasonable, and consistent with the precautionary approach to fishery management (Objective 1, Section 1.1.6). This target level is also consistent with simulation modeling results provided in the technical guidelines (Restrepo *et al*., 1998), relative to the selected precautionary fishing mortality level (Section 3.3.2). The recreational nature of the Atlantic billfish fishery, which is

managed with an objective to maintain the highest availability of billfishes to the U.S. recreational fishery (Objective 1 of the 1988 Atlantic billfish FMP), necessitates a precautionary management strategy that maximizes recreational encounter rates versus one that maximizes landings.

3.3.2 Precautionary Fishing Mortality Rate (F_{OY})

During rebuilding, F_{target} (Section 3.2.2) will be used to set fishing mortality levels to allow for biomass increases of overfished stocks. A similar parameter (F_{OY}) can be used after rebuilding has been accomplished to control fishing related mortality to ensure that MFMT is not exceeded, thereby preventing overfishing. This will also ensure that the biomass continues to increase to the B_{OY} level, thereby meeting an important objective of the Atlantic billfish FMP amendment (Section 1.1.6) to manage fisheries for the long-term optimum yield so as to maximize the net economic benefits of Atlantic billfish recreational fisheries (Objective 8).

A precautionary fishing mortality rate of 0.75MFMT (where MFMT = F_{MSY}) is selected for F_{OY}. The draft FMP amendment used an F_{OY} of 0.9MFMT, but further scientific analysis of these parameters indicated that a value of 0.75MFMT is more appropriate given the selected Minimum Biomass Flag level (Section 3.3.3). A 0.75MFMT would often result in an average biomass of $1.3B_{MSY}$, based on default values provided in the technical guidelines (Restrepo *et al*., 1998), consistent with the optimum yield target selected for this FMP amendment (Section 3.3.4). This level establishes a conservative approach for controlling fishing mortality, and also provides a margin of error that allows for a fishing mortality rate, given statistical uncertainties inherent in estimates of fishing mortality and biomass parameters, that would not trigger an overfished designation.

3.3.3 Biomass Approaching Overfished Trigger: Minimum Biomass Flag

Once rebuilding is complete, the biomass trigger is useful to managers because it signals a decline in biomass before it falls to a level where the stock must be classified as overfished and in need of rebuilding. Since this is a precautionary variable, the biomass trigger would be set at a level above the MSST of the overfishing status determination criteria (Figure 3.1.1). Consideration of the natural variations of population fluctuations would also be a component in setting this precautionary measure. Therefore the biomass approaching overfished trigger is set at $(1\text{-}M)B_{OY}$. Quantitative data necessary to calculate natural mortality rates of Atlantic billfish are not available, as discussed for the MSST component. Based on the estimated values of natural mortality used previously, and being mindful of the inherent variability of stock levels, a precautionary biomass trigger of $0.95B_{OY}$ for Atlantic blue marlin, $0.9B_{OY}$ for and Atlantic white marlin, and $0.8B_{OY}$ for west Atlantic sailfish, would be used as "trigger levels" of biomass at which time it becomes necessary to initiate management measures to reduce fishing mortality. Again, as noted for the selection of MSST in Section 3.13 which are tied to estimates of M, the minimum biomass flag values in the draft FMP amendment were increased to reflect a more precautionary approach, and to achieve greater parity with the NSG final rule. In terms of the biomass associated with maximum sustainable yield, these values translate to $1.24B_{MSY}$ for

Atlantic blue marlin, $1.1B_{MSY}$ for Atlantic white marlin and $0.98B_{MSY}$ for west Atlantic sailfish (given $B_{OY} = 1.3B_{MSY}$), which allows direct comparison to MSST values (Section 3.1).

3.3.4 Specification of Optimum Yield

The Magnuson-Stevens Act defines optimum yield as the amount of fish that: (1) will provide the greatest overall benefit to the nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; (2) is prescribed on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factors; and (3) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such a fishery.

In determining the greatest overall benefit to the nation, the NSGs summarize three values that should be weighed: food production, recreational opportunities, and protection of marine ecosystems. Specifically, the benefits of recreational opportunities are to "reflect the quality of both the recreational fishing experience and non-consumptive fishery uses such as ecotourism, fish watching and recreational diving, and the contribution of recreational fishing to the national, regional, and local economies and food supplies."

Billfish stocks in the Atlantic Ocean, as with all other fishery resources, have finite capacities. Any attempt to maximize the benefits of recreational opportunities will ultimately be constrained by maximum sustainable yield as impacted by social, economic and ecological factors toward defining of an optimum yield level. Social factors that must be considered by the Atlantic Billfish FMP amendment include: enjoyment gained from recreational fishing, economic benefits from tournaments, charter fishing and other billfish-related activities in communities throughout the Atlantic coast; and disputes between user-groups as a result of bycatch in commercial fishing gear. Economic considerations include: level of participation if billfish stocks decline to a level where recreational angler frustration causes them to stop or reduce fishing; the related economic impact on tackle and boat manufacturers, communities involved with billfish tournaments, and other support industries; and conversely, the economic impacts on these components as stocks begin to recover. Ecological factors that constrain the optimum yield level are stock size, age composition and reproductive potentials, as well as environmental perturbations. All sources of fishing mortality must also be counted against optimum yield, including those resulting from bycatch.

The Atlantic billfish FMP amendment focuses primarily on developing a management approach to rebuild overfished billfish stocks to increase U.S. recreational angling encounters. However, a management strategy that maximizes recreational encounters is different from one seeking to maximize landings, and will impact the selected level of optimum yield. To that end the optimum yield levels for Atlantic blue marlin, Atlantic white marlin and west Atlantic sailfish are shown in Table 3.3.1, and are defined as the amount of fish harvested that would not reduce the remaining biomass below 30 percent above the biomass level associated with maximum sustainable yield (i.e., $1.3B_{MSY}$). The specification of optimum yield follows the NSGs

as discussed in §600.310(f)(4)(i), which states that "the amount of fish that constitutes the optimum yield should be expressed in terms of numbers or weight of fish. However, optimum yield may be expressed as a formula that converts periodic stock assessments into target harvest levels. . ." A formulation value was used to estimate optimum yield that is related to maximum sustainable yield levels provided by ICCAT as part of Atlantic-wide assessments. The 1998 ICCAT recommendation delayed the 1999 schedule Atlantic billfish stocks assessment until 2000 for Atlantic blue and white marlin and 2001 for eastern and west Atlantic sailfish. Following the SCRS assessments, which will include evaluation of the impact of the 25 percent landing reductions (1997 ICCAT recommendation for Atlantic blue and white marlin), recovery scenarios will be developed, as appropriate, to levels that support maximum sustainable yield. If these recovery strategies meet the constraints of the Magnuson-Stevens Act, including recovery targets, limits, and explicit interim milestones, the United States would adopt an international rebuilding plan as discussed in Section 3.2.2.

Table 3.3.1. Summary of maximum sustainable yield, MSY control rule parameters, optimum yield and precautionary biomass and fishing mortality levels for Atlantic billfish.

	Blue Marlin	White Marlin	Sailfish
Maximum Sustainable Yield	4,461 mt	2,177 mt	~700 mt
1996 Observed Catch	4,439 mt	1,508 mt	~886 mt
Current Status of Atlantic Billfish Stocks			
1996 Replacement Yield	1,920 mt	921 mt	~600 mt
Relative Biomass (B_{1996}/B_{MSY})	0.236	0.226	~0.62
Relative Fishing Mortality (F_{1996}/F_{MSY})	2.87	1.96	~1.4
Status Determination Criteria			
MFMT	F_{MSY}	F_{MSY}	F_{MSY}
MSST	$0.9B_{MSY}$	$0.85B_{MSY}$	$0.75B_{MSY}$
Rebuilding Target and Fishing Mortality Levels			
B_{Target}	B_{MSY}	B_{MSY}	B_{MSY}
Allowable Landings/Year to Rebuild Stocks in 10 years	1,800 mt	800 mt	<600 mt
Precautionary Management: Optimum Yield and Associated Parameters			
Optimum Yield	1.3 B_{MSY}	1.3 B_{MSY}	1.3 B_{MSY}

3.4 Management Measures for Directed Fishing - Possession Restrictions

The United States initiated efforts to reduce mortality of Atlantic billfish beginning with the 1988 Atlantic Billfish FMP by prohibiting possession of Atlantic billfish, whether alive or dead, onboard commercial vessels inside the U.S. EEZ, and by requiring release of all Atlantic billfish caught by commercial vessels inside the U.S. EEZ. NMFS also developed regulations to prohibit the sale of Atlantic billfish from their management unit (management unit is defined in Section 1.3). To further reduce Atlantic billfish mortality rates from the recreational fishery operating in the U.S. EEZ, NMFS instituted minimum size limits to reduce Atlantic blue and white marlin recreational landings by approximately 50 percent and 30 percent for west Atlantic sailfish from pre-1988 levels. In addition, mandatory tournament reporting, if selected, was initiated by the FMP to provide a mechanism to estimate total catch and effort for the recreational fishery. The impacts on commercial discard rates and reductions in recreational landings are shown for Atlantic blue marlin and Atlantic white marlin in Figure 3.4.1 and Figure 3.4.2, respectively. Since 1988, the commercial fishery has annually discarded, on average, approximately 150 mt of Atlantic blue marlin and 80 mt of Atlantic white marlin. Annual recreational landings of Atlantic blue marlin have been reduced since 1988 by approximately 73 percent relative to pre-Atlantic billfish FMP levels (1980 to 1988); annual white marlin recreational landings have declined by approximately 90 percent over the same time frame. The reduction in recreational landings is due mainly to the conservation ethic of recreational billfish anglers, which has resulted in an increase in the number of billfish released, most of which are tagged as part of the CTC program (Section 2.3.3).

These conservation measures by the United States to decrease mortality levels of Atlantic blue and white marlin have reduced the level of U.S. contribution to Atlantic-wide catch levels relative to other ICCAT member countries, averaging 5.2 percent and 5.8 percent for Atlantic blue marlin and white marlin, respectively, between 1990 and 1996. As previously discussed, Atlantic-wide reductions are required to rebuild overfished Atlantic billfish resources. Actions taken by the United States alone can not effect sufficient reductions in mortality levels to rebuild these stocks (Table 3.2.1), as discussed in the final recovery period actions (Section 3.2.2). In the following section, domestic management actions are provided that are designed to meet the 1997 ICCAT recommendation to reduce Atlantic blue and white marlin landings by at least 25 percent, and to further reduce mortality levels toward rebuilding overfished Atlantic billfish resources. These domestic actions include: size limits; bycatch reduction; possession and retention; monitoring, permitting and reporting; and extension of the management unit and management authority.

Recreational angling for offshore species is an inherently dangerous activity (Section 3.10), therefore, in developing the final actions, NMFS considered safety issues associated with billfish angling. Recreational landings of Atlantic billfish must be reduced to comply with the 1997 ICCAT recommendation (for Atlantic marlins), as well as prevent further reductions of overfished Atlantic blue and white marlin, and west Atlantic sailfish stocks. The final FMP amendment utilizes minimum size limits to reduce the number of landed billfish. However, this action will require measurement of the length of the fish while still in the water (removal of fish

from the water that are under the size limit is prohibited). In consideration of the practical constraints associated with measuring a large pelagic fish an open ocean environment, NMFS selected final actions that maximize, to the extent practicable, the safety of recreational billfish anglers, including use of dehooking devices, and establishment of outreach programs that encompass safe handling techniques for measuring and releasing live billfish. However, recreational anglers should always exercise caution in handling these billed fish to avoid potential injuries

3.4.1 Size Limits

Size limits can be used to reduce total fishing mortality by minimizing the universe of potential fish that qualify for landing. Particular size or age classes of billfish can also be afforded protection by specifying sizes that maximize the reproductive potential of the available stock. Au (in press) recommends that female billfish be protected from exploitation until after they have spawned at least two successive years. The following minimum size limits for Atlantic billfish, expressed as lower jaw fork length (LJFL), have previously been utilized to restrict recreational landings:

Blue marlin: 99 inches (244 cm) LJFL (180 day Interim rule - September 29,1998, 63 FR51859; previous minimum size was 96 inches (244 cm) - March 24, 1998, interim rule [63 FR 14030]; minimum size established in the 1988 FMP was 86 inches LJFL);

White marlin: 66 inches (168 cm) LJFL (180 day Interim rules noted for blue marlin; minimum size established in the 1988 FMP was 62 inches LJFL)

Sailfish: 57 inches (145 cm) LJFL, established in the 1988 FMP; and

Spearfish: no minimum size

The use of minimum sizes would reduce the number of fish that are landed; however, NMFS must also consider the impact of handling or release mortality in evaluating the effectiveness of any management measure requiring the release of live fish. Accurate measures of release mortality are complicated by a variety of factors, including fishing techniques (e.g., type of tackle and bait, length of fight), location of hooking, water temperature, amount of handling at the boat, and size of the fish. Although there have been numerous studies on release mortality for freshwater and marine fishes, there is very limited information available on Atlantic billfish and other highly migratory species survival rates following an encounter with recreational fishing gear due to their size, range and behavior. Edwards *et al.* (1989) provides one of the few insights on release mortality for billfish in the Atlantic Ocean. A total of six blue marlin caught near St. Thomas, U.S.V.I., were tagged with ultrasonic transmitters and tracked from 2.2 to 6.4 hours, and were all alive at the time signals were lost. Although the sample size is small and the track time relatively short, this study does provide some preliminary indication that for this species, location and fishing technique (high-speed trolling resulting in marlin being hooked in the jaw),

short-term survival from the recreational encounter is high. Eight west Atlantic sailfish were tracked using similar acoustical telemetry methodologies off the east coast of Florida by Jolley and Irby (1979). All sailfish were caught by rod and reel, and tracked for periods of 2 hours 56 minutes to 28 hours 21 minutes. A total of seven of the eight sailfish were estimated to be alive at the time the fish were lost by the tracking equipment; one sailfish sustained a severe injury upon capture and was subsequently attacked by sharks 6 hours 25 minutes after release. In a study of hooking mortality of recreationally caught juvenile bluefin tuna, Belle (1997) found that 33 percent of these fish experienced immediate mortality as a result of the capture process. These limited studies indicate the need to obtain an accurate assessment of release mortality to quantify impacts of size limit restrictions and other management tools as effective mechanisms to reduce fishing-related mortality rates.

Size distributions from Atlantic billfish landed in tournaments sampled during 1995 to 1997 by the Recreational Billfish Survey (Section 2.3) were used to evaluate all size limit alternatives. Although size information is available beginning in 1972, only the most recent information was used to ensure that size distributions most accurately reflect the current population structure. In the RBS database, often only weight of a fish was available. Therefore, to maximize the amount of information for evaluation of size limit alternatives, lower jaw-fork length was calculated from weight measurements using the following length (inches) - weight (pounds) conversions (calculated from complete length-weights for the 1995-1997 time frame):

Blue marlin: $\log_{10}\text{LJFL} = 1.323 + 0.268 \log_{10}\text{Weight}$
(N = 308, R-squared = 0.85)

White marlin: $\log_{10}\text{LJFL} = 1.455 + 0.208 \log_{10}\text{Weight}$
(N = 71, R-squared = 0.66)

Sailfish: $\log_{10}\text{LJFL} = 1.323 + 0.268 \log_{10}\text{Weight}$
(N = 96, R-squared = 0.56)

Application of these equations enabled a recovery of length measurements for 195 blue marlin, 56 white marlin, and 19 sailfish, yielding size frequency distributions for 503 blue marlin (Figure 3.4.3), 127 white marlin (Figure 3.4.4) and 115 sailfish (Figure 3.4.5) landed during 1995 to 1997. There were insufficient landings of longbill spearfish to generate a meaningful size frequency distribution plot. Cumulative percent of total landings, by one-inch size categories, were calculated for blue marlin (Figure 3.4.6), white marlin (Figure 3.4.7) and sailfish (Figure 3.4.8) to illustrate the impact of various "break-points" considered under the size limit alternatives.

Final Action: Institute minimum size limits for Atlantic blue marlin at 99 inches (251 cm) LJFL, Atlantic white marlin at 66 inches (168 cm) LJFL, and west Atlantic sailfish at 63 inches (160 cm) LJFL.

Ecological Impacts

Increase in the size limits will be the primary mechanism utilized by the final Atlantic billfish FMP amendment to reduce recreational billfish landings, and comply with the 1997 ICCAT recommendation to reduce landings by at least 25 percent by the end of 1999. During the 1998 fishing season, size limits established by an interim rule (63 FR 14030, March 24, 1998) were 96 inches (244 cm) LJFL for Atlantic blue marlin, and 66 inches (168 cm) LJFL for Atlantic white marlin. The size limits established in the interim rule were based on the best available information at the time; however, subsequent information indicated that the minimum size limit of 96 inches (244 cm) LJFL for Atlantic blue marlin may not be adequate to achieve the required 25 percent reduction. Therefore, the size limit for blue marlin was further increased to 99 inches in the September 29, 1998 interim rule (63 FR 51859). A summary of the reduction in number of blue marlin and associated weight for sizes ranging from 96 inches LJFL to 120 inches LJFL is provided in Table 3.4.1. An increase in the size limit for blue marlin to 99 inches (251 cm) LJFL will ensure compliance with the 1997 ICCAT recommendation, with a projected reduction in landings of 32.4 percent by weight (Figure 3.4.6). The 66 inch LJFL size limit for Atlantic white marlin established in the interim rules is sufficient to meet required reductions with a projected 42 percent decrease in landings by weight (Table 3.4.2; Figure 3.4.7). However, if monitoring of landings indicates that size limits are insufficient to avoid exceeding Atlantic blue and white marlin landing caps (Section 2.1.3.6), NMFS will either implement an interim measure to temporarily raise size limits for the remainder of the fishing year, or, if necessary, implement longer-term changes in size limits through proposed and final rules, as outlined in the framework provisions of the FMP amendment (Section 3.11).

The 1997 ICCAT recommendation did not consider reductions in west Atlantic sailfish landings. However, under the status determination criteria developed for the Atlantic billfish FMP amendment (Section 3.1) west Atlantic sailfish would be considered as overfished. West Atlantic sailfish mortality rates can immediately be reduced by increasing the minimum size, using similar criteria utilized for the blue and white marlin. The current size limit for west Atlantic sailfish is 57 inches LJFL (approximately 32 pounds), which is at or below the size-at-maturity for female sailfish (Section 4.3). Increasing the minimum size limit to 63 inches (160 cm) LJFL (approximately 41 pounds) would reduce landings by approximately 35 percent by weight (Figure 3.4.8). A summary of the reduction in number of west Atlantic sailfish and associated weight for sizes ranging from 60 inches LJFL to 65 inches LJFL is provided in Table 3.4.3. There is a sharp break in the sailfish size limits between 62 and 63 inches LJFL. A one-inch smaller size limit (62 inches LJFL) would provide only a 17.4 percent reduction in landings by weight, based on 1995 to 1997 landings.

Although decreases in landings with the increased size limits would provide immediate reductions in current fishing mortality levels, the exact impact on total mortality is unknown since size limits and resultant landing reduction estimates were based only on fish taken during fishing tournaments. It is possible that tournament size frequencies are skewed to larger sizes, based on the nature of tournament fishing (i.e., a large fish is needed to offer a chance at winning

a prize). If this is the case, then these size limits would provide greater reductions in fishing mortality than currently projected.

The increase in size limits for Atlantic billfish would also provide an increase in reproductive potential, which would lead to a long-term benefit for the Atlantic-wide stock. An increase in minimum size limit for west Atlantic sailfish that would prohibit landing of fish under 40 pounds would provide sailfish an additional opportunity for reproducing prior to being recruited to the recreational fishery (except for mortality associated with catch and release). Size increases for blue and white marlin, although previously above the minimum spawning size, would allow additional spawning opportunities for larger fish that potentially could provide a long-term increase in the reproductive potential.

Economic Impacts

The impact of the increase in minimum sizes for Atlantic billfish on various sectors of the recreational fishing industry is uncertain; however, based on responses received during the public comment period for the proposed rule, it is not anticipated that the increase in size limits will have a negative economic impact on Atlantic billfish anglers. The billfish recreational fishery voluntarily releases approximately 90 percent of all billfish caught, and in fact this percentage may be higher based on the expanded efforts of conservation groups (e.g., The Billfish Foundation, Coastal Conservation Association, International Gamefish Fishing Association, and Recreational Fishing Alliance) based on testimony received during the public comment period for the proposed rule implementing the Atlantic billfish FMP amendment. Since billfish fishermen (private and for-hire customers) derive enjoyment from catching billfish, without retaining a large portion of what is caught, there would likely be little or no change in the number of fishing trips due to the release of fish that would be required under the increased minimum sizes. This conclusion is supported by results of opinion surveys of billfish tournament anglers by Fisher and Ditton (1992) and Ditton and Clark (1994) (see Social Impacts below). As stocks are rebuilt to optimum yield target levels ($1.3B_{MSY}$; Section 3.3), encounter rates with larger fish will become more frequent, and will likely result in a long-term net economic benefit associated with increased recreational participation.

The impact of increased size limits on tournaments and other support industries to the billfish fishery is also likely to be minimal, with the possible exception of taxidermists; however, retention of the billfish is not required. NMFS did not receive any negative comments from the taxidermist industry regarding this issue. The impact on this industry of a 25 percent decrease in landings depends in large part on the share of current and future landings that are used for such purposes. However, other fisheries that support tournaments (for example sharks and tarpon) have successfully made the transition to mainly catch and release, in an effort to limit the number of fish being landed; indeed several billfish tournaments have already incorporated similar systems.

The cost of enforcement of these proposed minimum size increases should not increase since size limits already exist under current regulations. There would be some short-term

increase in management costs associated with communicating new size limits to recreational fishing community.

Social Impacts

Most recreational billfish anglers will likely support the increase in minimum size limits based on public remarks made during the comment period to the proposed rule, and the nearly unanimous support of this measure by the Billfish AP . This conclusion is also supported by the 1992 study by Fisher and Ditton of billfish tournament participants that examined angler opinions of various fisheries management options, including increases in minimum size limits. Responses from anglers were tallied for five possibilities: strongly disagree, disagree, neutral, agree and strongly agree. When responding to the question of supporting increased billfish minimum size, 20 percent of the sample population were neutral, 30 percent agreed, and 30 percent strongly agreed with this management strategy. Ditton and Clark (1994) offered a similar suite of questions to billfish tournament anglers fishing in Puerto Rico. Billfish anglers that were residents of Puerto Rico did not strongly support (34 percent) an increase in minimum sizes. Non-residents, however, strongly supported increased size limits (74 percent).

Conclusion

The increase in minimum sizes for Atlantic blue marlin to 99 inches (251 cm) LJFL, 66 inches LJFL for Atlantic white marlin and 63 inches (160 cm) LJFL for west Atlantic sailfish is the final management action because it would reduce mortality rates by at least 25 percent for each of these overfished species at minimal short-term economic expense with long-term economic benefits. The final action was supported by the Billfish AP; most of the public responses also voiced support for this measure. Although currently-reported landings by U.S. recreational anglers represent a small percentage of the total Atlantic billfish mortality level (for 1996: Atlantic blue marlin - 0.8 percent; Atlantic white marlin - 0.2 percent; and west Atlantic sailfish - 0.14 percent), these efforts are part of a management strategy that can be used as part of a larger framework for rebuilding these stocks.

Rejected Option: No Action Alternative (Status Quo)

Ecological Impacts

The status quo alternative would retain size limits under previous regulation (Atlantic blue marlin - 86 inches LJFL, Atlantic white marlin 62 inches LJFL, and west Atlantic sailfish - 57 inches LJFL), since the interim rule (63 FR 51859; September 29, 1998) can be in effect only through March 19, 1999. Continued landings at current levels could violate the 1997 ICCAT recommendation to reduce landings by 25 percent from 1996 levels, and may not contribute to reducing fishing mortality towards rebuilding of overfished stocks. Maintenance of current size limits for west Atlantic sailfish would also allow for continued landing of potentially immature female sailfish.

Economic Impacts

Although there may be a short-term increase in fishing activity and associated revenue with a decrease in size limits established in the interim rule, taking no action to reduce fishing mortality would allow overfished billfish stocks to decline further. This would result in reduced net benefits to society in the long-term.

Social Impacts

If stocks continue to be overfished, billfish anglers will likely experience a reduction in recreational satisfaction as encounters with target species become less frequent.

Conclusion

This alternative was not preferred because it would contribute to continued overfishing and prevent rebuilding within the constraints of the Magnuson-Stevens Act provisions.

Rejected Option: Slot limits (minimum and maximum sizes) to protect immature fish and large spawners, and allow retention of "trophy" fish.

The following table summarizes, by species, allowable and prohibited sizes under this alternative (all measurements are given in inches, LJFL):

	Atlantic Blue Marlin	Atlantic White Marlin	W. Atlantic Sailfish
Release of Juvenile Fish	under 70	under 58	under 52
Retention Allowed	70 to 85	58 to 64	52 to 57
Release of Reproductive Size Fish	86 to 113	65 to 70	58 to 66
Retention of "Trophy" Fish	above 113	above 70	above 66

Ecological Impacts

Many of the ecological impacts discussed under the final action would also apply to use of slot restrictions as a mechanism to reduce fishing mortality. Maximum size limits can be established to prevent the take of the larger individuals which are generally all females, the largest of which produce relatively greater numbers of eggs and thus potentially contribute more

to the reproductive success of the stock than do smaller females. Conversely, minimum size limits can protect juveniles, although these are generally not encountered in the recreational fishery (Figures 3.4.4, 3.4.5 and 3.4.6).

The slot limits would theoretically result in the following percent decreases (by weight) from the 1995 to 1997 recreational billfish landings: blue marlin - 78 percent (Figure 3.4.6); white marlin - 60.4 percent (Figure 3.4.7); and sailfish - 62 percent (Figure 3.4.8). However, these percentages are likely to be an over-estimate of actual reductions in landings due to the size category that allows for retention of fish below current minimum size limits. Therefore the percent reductions reflect, for all intents and purposes, an alternative minimum size limit corresponding to the "trophy" size category (Atlantic blue marlin - 113 inches LJFL; Atlantic white marlin - 70 inches LJFL; and west Atlantic sailfish - 66 inches LJFL). It is unknown what the actual percent reductions in fishing mortality would be, given the ability to catch smaller, and more readily available billfish. It is possible that if recreational anglers change fishing practices to target these smaller fish, fishing mortality under this alternative could actually increase, thereby invalidating any rebuilding efforts. Given the sexually dimorphic growth characteristics of billfish (Section 4.3), the smaller fish would likely consist of immature/maturing females and mature males.

Economic Impacts

It is difficult to assess the economic impact of this alternative because the projected landings can not be accurately assessed. Prohibiting the landing of billfish typically found in billfish tournaments (i.e., Atlantic blue marlin - 86 to 113 inches LJFL, Atlantic white marlin - 65 to 70 inches LJFL, and west Atlantic sailfish - 58 to 66 inches LJFL) may have a negative impact on tournament anglers and lead to a decrease in tournament participation. This would have a negative impact on the local economy of tournament sites. If landings of small fish increase, this could negate rebuilding efforts, leading to reduced angler participation and loss of net economic benefits.

Social Impacts

If anglers begin to target smaller fish, there could be an increase in recreational participation associated with broadening the potential number of fish available for landing (assuming there are relatively more smaller than larger fish). However, landing of a small billfish may conflict with the conservation ethic of many billfish anglers. Prohibition of landing fish typically of a size found in billfish tournaments could result in long-term angler dissatisfaction. This is supported by the social and cultural impact assessment of the HMS FMP and Atlantic billfish FMP amendment (Chapter 7), indicating that in areas where billfish tournaments are held (Hatteras, NC and Panama City, FL), slot limits with an upper boundary of 113 inches LJFL would have a negative impact on tournament participation. In addition, the slot limits may also lead to an increase in angler confusion and frustration with regulatory constraints, without a clear correlation with rebuilding of billfish resources.

Conclusion

This alternative was rejected because of the unknown impacts on rebuilding overfished billfish stocks by allowing landing of fish below previous minimum size limits, and the likely negative impacts of disallowing landings of fish of a size typically found in billfish tournaments.

3.4.2 Retention Limits

Current regulations prohibit both commercial and recreational fishers from selling Atlantic billfish, and possession onboard commercial fishing vessels inside the U.S. EEZ. The "no-sale" and "no possession" provisions were cornerstone actions of the Atlantic Billfish FMP, and were instituted to eliminate the commercial incentive to catch and/or land a billfish. Since the billfish FMP was introduced in 1988, billfish regulations have been strengthened to close loopholes that allowed the illegal possession of Atlantic billfish, sold under the guise of similar species. NMFS amended the billfish regulations in 1991 to prohibit the possession of black marlin, striped marlin, or shortbill spearfish, by a dealer or seafood processor, without documentation to prove that the fish was harvested outside of the management unit. NMFS introduced this regulatory change because the four original billfish species, in their market form, were indistinguishable from the three "related species." Enforcement of the "no-sale" provision is difficult, primarily because the "Certificate of Eligibility for Billfishes" is the only way for an enforcement officer to distinguish between Atlantic billfish harvested from its management unit, and those from areas where harvest is not prohibited (e.g., Pacific Ocean). The certificate creates a paper trail that lists the names of persons who have handled the billfish on its route from the Pacific Ocean to the seafood consumer.

Although the prohibition on sale, barter, or trade of Atlantic blue and white marlin extends throughout the north Atlantic Ocean (the management unit is north of 5°N; see Section 1.3), possession and/or retention restrictions for commercial and recreational entities apply only shoreward of the outer boundary of the EEZ. The final action under Section 3.9 extends the management unit for Atlantic blue and white marlin to the entire Atlantic, and because the Atlantic marlin measures of this amendment will be implemented under the dual authority of the Magnuson-Stevens Act and ATCA, the possession and retention limitations are extended to all U.S. commercial and recreational vessels, regardless of where they operate, as well as to U.S. citizens wherever they fish in the Atlantic Ocean.

The management alternatives discussed under the possession and retention action provide additional mechanisms to reduce mortality of billfish from the recreational fishing sector, toward rebuilding Atlantic billfish resources, thereby meeting Objectives 1 and 2 of the FMP amendment. The long-term application of activities under these retention limit actions will also be an integral part of meeting the long-term objective of optimum yield (Objective 8).

Final Action: Prohibit the retention of longbill spearfish.

Ecological Impacts

Biological information on longbill spearfish is extremely limited. Catches of sailfish and spearfish have been reported together in ICCAT landing statistics, complicating evaluation on the status of longbill spearfish stocks in the Atlantic. Longbill spearfish are generally considered to be the rarest Atlantic istiophorid (SCRS 1997). They are not targeted by recreational billfish anglers in the Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea. A recreational

encounter with longbill spearfish is a rare event as illustrated by the number of spearfish tagged as part of the CTC program. Between 1988 to 1995, a total of 44,181 billfish were voluntarily tagged and released in the Atlantic, including, Atlantic blue marlin - 30.1 percent; Atlantic white marlin - 21.48 percent; west Atlantic sailfish - 48.0 percent; and only 0.44 percent were longbill spearfish (Table 3.4.4). The low encounter rates of longbill spearfish are corroborated by results from the cooperative RBS (NMFS 1997) which documented only 4 spearfish out of 3,682 billfish caught in Atlantic coast billfish tournaments during 1994; in 1995, a total of 4,260 billfish were caught in the sampled tournaments, including only 5 spearfish (0.12 percent). Although the disposition of the caught longbill spearfish was not reported, recreational billfish anglers generally release all longbill spearfish.

Prohibiting the retention of longbill spearfish by recreational billfish anglers is a precautionary management measure, and as such, is a strategy supported by the Magnuson-Stevens Act. The status of longbill spearfish stocks is unknown, and the rare nature of this species necessitates a cautious management strategy to avoid any potential negative impacts to the stock. The Billfish AP, however, did not support this measure, voicing concern that a lack of information is not an adequate reason to prohibit retention, and that retention should be allowed until further data is made available that indicates that longbill spearfish are overfished. As more scientific information becomes available, this prohibition could be reversed, as discussed in the framework section.

Economic and Social Impacts

An exact assessment of the economic impacts of prohibiting the possession and landing of longbill spearfish is not possible due to a paucity of data concerning this species. However, since spearfish are not targeted by recreational anglers, and if a spearfish is caught (less than 0.5 percent of all recreationally-caught billfish are spearfish), it is generally tagged and released, the economic impact of not allowing retention of a spearfish should be minimal. Prohibiting longbill spearfish retention should also have no impact on billfish tournaments, which generally have no longbill spearfish category and do not award for their capture. Most recreational billfish anglers consider themselves as conservation-oriented (Section 2.1.4 and Chapter 7) and will likely not object to this precautionary management measure, although during the public comment period for the proposed rule, NMFS received several responses that there was no reason to prohibit longbill spearfish landings due to the lack of scientific information.

Conclusion

The unknown status of longbill spearfish stocks and their rare occurrence in the Atlantic necessitate a precautionary management approach. Prohibiting possession and landing of longbill spearfish will have minimal negative social or economic impact, and any reduction in potential fishing mortality will help maintain and/or rebuild current stock levels.

Final Action: Status quo on current commercial possession and retention restrictions.

Ecological Impacts

Atlantic blue marlin and Atlantic white marlin were designated as overfished in the 1997 NMFS report to Congress on the status of U.S. fisheries. The overfished designation for blue and white marlin is corroborated under the status determination criteria of the Atlantic Billfish FMP amendment, and also includes west Atlantic sailfish. A critical component in the rebuilding of these overfished stocks is reducing fishing mortality. Commercial fishing entities are already prohibited from possessing and retaining any Atlantic billfish from its management unit, as outlined above. Sale of Atlantic billfish from their management unit is also prohibited. Under the status quo alternative, the commercial sector would continue to be prohibited from possessing and retaining Atlantic billfish. Regarding Atlantic blue and white marlin, this prohibition would be implemented under the dual authority of the Magnuson-Stevens Act and ATCA, thereby extending prohibitions beyond the U.S. EEZ.

Economic Impacts

The economic impact of prohibiting the sale of billfish was estimated in the 1988 Atlantic Billfish FMP to be approximately $500,000 per year. The estimates of commercial fishery gross revenue forgone (Section 2.1.4) were close to this value, with an average of $664,648/year lost to the commercial fishing sector by not being able to land Atlantic blue marlin, Atlantic white marlin, longbill spearfish or west Atlantic sailfish. Under the status quo alternative, recreational revenues would likely remain unchanged in the short-term; however, if fishing mortality levels are not reduced and Atlantic billfish stocks are not rebuilt, then it is possible that the net benefits from the recreational billfish fisheries would be negative as billfish abundance levels experience further decline.

Social Impacts

The final action for status quo would provide no change to the current possession and retention restrictions. If fishing mortality continues at current levels, overfished billfish stocks will not recover to rebuilding target levels, leading to negative social impacts in the long term. Several comments were received during the comment period on the proposed rule concerning the ability for recreational anglers to retain Atlantic billfish, and possibly profit from the ability to retain a fish in conjunction with a billfish tournament. Recreational anglers release a majority of fish that are caught, resulting in approximately 5 to 20 percent of the total U.S. Atlantic billfish mortality reported to ICCAT each year; the remaining billfish mortality is attributable to dead discards from pelagic longline gear. Further, it is NMFS' understanding that billfish are not sold, bartered or traded to receive a tournament prize, but remain the property of the angler who landed the fish.

Conclusion

This alternative (continue no retention and possession by commercial vessels) was included as a final management action because it would contribute to continued reductions in mortality rates toward eliminating overfishing, and ultimately rebuilding overfished Atlantic billfish resources, and was unanimously supported by the Billfish AP.

Rejected Option: Establish a recreational bag limit of one billfish per vessel per trip, with authority to adjust the bag limit, including to zero.

This was a preferred alternative in the draft FMP amendment. A single marlin retention (bag) limit per vessel per trip, with the additional caveat that the AA could adjust the bag limit to zero if the Atlantic marlin landing caps were exceeded was also included in the September 29, 1998, extension of the size limit interim rule (63 FR 51859). NMFS received many comments regarding the negative economic impacts of the provision in the interim rule that would make a zero bag limit a possibility. On November 13, 1998, a technical amendment was published (63 FR 63421) amending the September 29, 1998, interim rule to remove the adjustable bag limit provision.

Ecological Impacts

Atlantic billfish are generally solitary, oceanic and wide-ranging species, although sailfish have been found in small schools in warm coastal waters (see Section 4.3). These behavioral patterns make recreational billfish fishing a relatively "rare event," taking 5 to 30 days (fishing 8 hours/day) to catch a blue marlin, 8 to 20 days for a white marlin, and 5 to 20 days to catch a sailfish, depending on location and time of year (Fedler and Ditton, 1990; Ditton and Clark, 1994). The majority of recreationally-caught fish are released, ranging from 74 to 99 percent (Table 2.1.7, and Fisher and Ditton, 1992), depending on area, with many of the released fish being tagged as part of the NMFS Cooperative Tagging Center (CTC) program (Jones *et al.*, 1997). Fisher and Ditton (1992) found that retention rates for billfish tournament anglers in 1989, on a per angler basis, ranged from 0.35 billfish/year in the mid-Atlantic to 2.87 billfish/year in the Caribbean, averaging 0.68 billfish/year across all Atlantic-based recreational billfish fisheries (Table 2.1.7).

In consideration of the relatively rare nature of these species, and the fact that a large majority of fish are released by recreational anglers, including billfish greater than the minimum size, landings may be better controlled solely by size limits. This conclusion is supported by comparisons of Atlantic billfish catches, landings, and retention ratios in the Gulf of Mexico in during 1996 and 1998 (preliminary data only). As summarized above, two interim rule measures were implemented during 1998 to increase the minimum size limit for Atlantic blue and white marlin. These interim measures were designed to immediately comply with the 1997 ICCAT recommendation to reduce Atlantic blue and white marlin landings by at least 25 percent, from 1996 level, starting in 1998, and to be completed in 1999, until an FMP amendment could be completed. Analysis of preliminary catch and landing information from Gulf of Mexico fishing tournaments during 1998, relative to 1996 levels, shows that the number of Atlantic blue and white marlin landed in tournaments declined during 1998 (Table 3.4.5), with similar recreational

effort expended in both years (1996 - 19,467 hours of trolling, 1998 - 18,077 hours of trolling). However, to ensure comparisons were made in the proper context, retention rates (number caught vs. number boated) were calculated (Table 3.4.6). In addition, the majority of the fishing season in the Gulf of Mexico occurred before the September 29, 1998 extension, therefore these tournaments operated under a 96 inch LJFL minimum size for Atlantic blue marlin. To allow direct comparison to the final action in this FMP amendment of 99 inch LJFL for Atlantic blue marlin (Section 3.4), the size frequency of fish landed in the Gulf of Mexico was examined. Five of the 22 fish boated during 1998 were between 96 inches and 98 inches LJFL. The resultant impact of the 99 inch LJFL regulation on Atlantic blue marlin would be a 36.6 percent reduction in landings, and 82.4 percent in Atlantic white marlin landings. These reductions, although preliminary and reported in number, rather than in weight as reported to ICCAT, indicate that size limits alone have been effective in reducing landings.

Economic and Social Impacts

Public comments on the interim and proposed rule indicate a zero bag limit could have a more significant economic impact than reported in either the Regulatory Impact Review (RIR) for the interim rule or in the RIR included in the draft FMP amendment, particularly in relation to billfish tournaments. Comments indicate that tournaments would be canceled, or at least experience significant reduction in participation, due solely to the *possibility* of a prohibition of landing of any fish. On December 29, 1998, NMFS published a supplementary draft RIR/IRFA that analyzed the economic impacts of the zero bag limit provision.

During the comment period for the proposed rule implementing the draft Atlantic billfish FMP amendment and HMS FMP, many written and verbal responses were received by NMFS voicing concern about the need for a bag limit given the rare nature of billfish catches, and even rarer incidences of multiple billfish landings by U.S. recreational anglers. In fact, many commenters indicated that landing an Atlantic billfish is becoming increasingly "socially unacceptable" within the recreational angling community. Additional comments were also received in support of the significant negative economic impact of a zero bag limit, or even a potential zero bag limit, to tournament and charter vessel operations.

Conclusion

NMFS has determined that U.S. recreational angler landings can effectively be regulated through size limits, ensuring compliance with ICCAT landing limits for Atlantic blue marlin and white marlin (26.2 mt and 2.48 mt, respectively). Any additional reductions in landings can be achieved by further increases in the minimum size limit. Further, if necessary to comply with ICCAT landing reductions, NMFS may promulgate an emergency rule to prohibit retention of blue and white marlin. Since NS7 requires that conservation and management measures should avoid unnecessary duplication, additional measures to control Atlantic billfish mortalities from the recreational sector are not necessary at this time. The bag limit and provision providing the AA the authority to adjust the retention limits, including a zero bag limit, therefore, are rejected management measures in the final Atlantic billfish FMP amendment.

Rejected Option: Prohibit the possession of any live or dead Atlantic billfish on board a U.S. recreational vessel.

Ecological Impacts

This alternative would prohibit the possession and retention of Atlantic billfish by U.S. recreational anglers. The impact of eliminating recreational landings can be estimated from the currently reported U.S. billfish landings to ICCAT. In 1996, 34.9 mt of Atlantic blue marlin, 3.3 mt of Atlantic white marlin and 1.2 mt of west Atlantic sailfish were reported as landings for the U.S. recreational sector. Under the 1997 ICCAT recommendation, the 1999 U.S. landing limits for Atlantic blue marlin will be 26.2 mt, and 2.48 mt for Atlantic white marlin. The ICCAT recommendation did not include longbill spearfish or west Atlantic sailfish. Therefore, the total potential reduction of fishing mortality imposed by a zero bag limit, beginning in 1999, will be 26.2 mt for blue marlin, 2.48 mt for white marlin and 1.2 mt for west Atlantic sailfish (total 1996 sailfish landings above the current minimum size). This translates to approximately 160 blue marlin, 100 white marlin and 60 sailfish using the average weights for fish landed during 1995 to 1997. These reductions in fishing mortalities should be considered as minimum estimates because, as previously discussed, the actual landings levels for the recreational billfish fishery are unknown. The currently reported landings are based on tournament sampling and the Large Pelagic Survey estimates, which may lead to under-reporting of actual U.S. recreational landings.

Economic Impacts

The institution of a zero retention limit for billfish would have an immediate negative impact on the revenues associated with billfish tournaments (Chapter 5). If tournaments are canceled or experience reduced participation, there are support businesses that would subsequently be negatively effected. On a local level, these businesses could include hotels, restaurants, charters, bait and tackle suppliers, and taxidermists. On a wider scale, it is possible that boat, gear and tackle manufacturers could experience losses in sales. However, a measure of the extent of these effects is difficult to estimate in terms of lost revenues, or reductions in the willingness of billfish anglers to expend funds beyond the direct costs of the fishing experience. If the $32,281 figure from Fisher and Ditton (1992) of each landed billfish is used, then the potential economic impact of a zero bag limit (i.e., the projected impact of not landing the estimated limit of 320 billfish for 1999) would be $10.3 million in reduced expenditures. The long-term impacts may result in an increase in net benefits as stocks are rebuilt and recreational encounters become more frequent.

Social Impacts

Recreational billfish anglers who participate in tournaments generally support some type of bag limit, although this conclusion was not supported by public comments received on the proposed rule. In a study of U.S. recreational billfish tournament anglers fishing in the Atlantic, Fisher and Ditton (1992) found that most fishermen were either neutral (16.3 percent), agreed

(24.1 percent) or strongly agreed (33.8 percent) with a zero bag limit. In a study of billfish anglers fishing in Puerto Rico, Ditton and Clark (1994) found that residents generally disagreed with a zero bag limit (49.3 percent), while non-residents supported this management measure (58.9 percent). It is also unknown what the reaction would be from non-tournament billfish anglers. Although there is evidence that this measure would be supported by the recreational community from these opinion survey studies, when faced with an actual zero bag limit, anglers may be more resistant to this management measure. A zero retention limit for recreational anglers was not supported by the Billfish AP.

Conclusion

Although a no retention alternative provides the most precautionary measure in reducing fishing mortality, when U.S. recreational landings are compared to U.S. commercial dead discards, and to Atlantic-wide mortality reductions necessary to rebuild highly migratory billfish resources, prohibiting landings may be an overly restrictive measure on the recreational fishery. Therefore, the zero retention limit was not selected as a final management alternative.

Rejected Option: Allow landing of Atlantic blue marlin and Atlantic white marlin only from charter vessels and by all vessels during fishing tournaments.

Ecological Impacts

Under this alternative, recreational landings of Atlantic blue marlin and Atlantic white marlin would be allowed only during fishing tournaments and from charter vessels; all other recreational landings of marlins would be prohibited. West Atlantic sailfish would not be included in this prohibition, and landing of sailfish by all recreational anglers would be allowed subject to a minimum size limit. The rationale behind this alternative is that NMFS does not have an adequate monitoring system in place to monitor billfish landings outside the tournament environment. The 1997 ICCAT recommendation to reduce Atlantic blue and white marlin landings by at least 25 percent from 1996 levels established a cap for U.S. recreational landings of 26.2 mt of Atlantic blue marlin and 2.48 mt of Atlantic white marlin, based on 1996 reported recreational landings (34.9 mt and 3.3 mt, respectively). Currently, billfish landings are estimated from the Large Pelagic Survey and RBS (Section 2.3).

The 1997 ICCAT recommendation also called for improved monitoring of billfish landings. To that end, all billfish tournaments must register four weeks prior to commencement, noting the purpose, dates and location of the tournament as a result of the March 24, 1998 (63 FR 14030) and September 29, 1998 (63 FR 51859) interim rule measures. The final actions under Section 3.8 (Monitoring, Permitting and Reporting) makes the tournament reporting mandatory. Selected tournaments must report the information listed in Section 2.3 within 7 days of the conclusion of the tournament, together with a copy of the tournament rules. Other final actions under Monitoring, Permitting and Reporting establish an HMS charter vessel permit and logbook system, and a voluntary observer program, which provide additional mechanisms to monitor Atlantic blue and white marlin and west Atlantic sailfish landings from charter vessels.

Economic Impacts

Since the total number of Atlantic blue marlin and Atlantic white marlin recreational anglers is not known, it is difficult to assess the impact of prohibiting the landing of marlins not associated with charters or tournaments. However, because over 90 percent of all billfish are released by recreational anglers, and considering that west Atlantic sailfish are not included in this alternative, the economic impacts are likely to be minimal. The long-term impacts may result in an increase in net benefits as stocks are rebuilt and recreational encounters become more frequent.

Social Impacts

There would appear to be support for this type of action based on the results of a survey of billfish tournament anglers by Fisher and Ditton (1992); however, this conclusion was not supported based on responses received during the comment period for the proposed rule. Under this alternative, Atlantic blue and white marlin could still be landed as part of a fishing tournament and from charter vessels, two likely sources of negative response to a zero bag limit. Allowing landing of west Atlantic sailfish, likely will add further to the support of this alternative. The Billfish AP expressed concern that this measure would unnecessarily penalize private vessels.

Conclusion

The total landings of Atlantic blue marlin and Atlantic white marlin by recreational anglers are unknown, but landings of Atlantic blue marlin and Atlantic white marlin from tournaments and charter vessels are quantified. Although this alternative would provide a convenient means to ensure that U.S. marlin landings are fully monitored and comply with ICCAT-recommended levels, there are no economic or social benefits that can be identified using this management strategy. Therefore, this alternative was not selected as a final management action.

Rejected Option: Allow only catch-and-release format for all Atlantic billfish tournaments.

Ecological Impacts

The 1988 Atlantic Billfish FMP included a "no-kill" tournament alternative in the management options considered. Although it was ultimately rejected as being too burdensome at the time, the SAFMC strongly recommended that all tournaments adopt the no-kill format. Subsequently, many tournaments have adopted strategies to reduce or eliminate landings as prerequisite for qualifying for tournament prizes. However, billfish are still landed during many

billfish tournaments; the RBS samples approximately 90 percent of billfish tournaments in the Atlantic with U.S. angler participation, either through direct sampling or tournament reporting, (Dr. Eric Prince, pers.comm.). In 1995, the RBS reported that a total of 4,308 billfish were caught by U.S. billfish anglers during billfish tournaments in the Atlantic, Gulf of Mexico and Caribbean (Table 2.1.8), with 3,976 billfish released, giving a total 332 billfish that were landed. The total weight of these landed fish was approximately 35 mt, or about 56 percent of the recreational landings (weight) reported to ICCAT for 1995 (Table 2.1.4). As noted previously, however, the actual percentage of billfish landed during tournaments is unknown relative to the total number of billfish landed from all recreational sources.

Economic Impacts

A prohibition on landing billfish caught during a fishing tournament (i.e., catch-and-release only tournament format) would likely have a short-term negative impact on angler participation in billfish tournaments. Using the economic figures cited by Fisher and Ditton in the discussion of the zero bag limit alternative, and assuming that tournaments are responsible for about half the billfish landings (although it could be less), the economic impact of no kill tournaments would be approximately $5.16 million in reduced expenditures. However, if billfish tournament anglers support a catch-and-release tournament format, there would be no negative economic impact because an equivalent number of fish could still be caught, with an average reported value of $4,242 (Fisher and Ditton 1992, Section 2.1.4). As alternative means are employed to monitor and validate billfish fishing activity for tournament prizes that do not involve landing the fish, it is possible that a long-term net benefit can be realized as billfish encounter rates increase with recovery of the stocks.

Social Impacts

As with other measures that limit landings of billfish, Fisher and Ditton (1992) found that 73.8 percent of billfish tournament anglers supported (54.1 percent) or were neutral (19.7 percent) in regard to mandatory "no-kill" tournaments. However, as previously noted, management restrictions limiting landings beyond minimum size limits, were strongly opposed by public comment on the proposed rule, nor was it supported by the Billfish AP. The opinions of billfish anglers fishing in Puerto Rico (Ditton and Clark 1994) were less supportive of mandatory prohibition of landings during tournaments, with a total of 43.8 percent of resident and 59.3 percent of non-resident anglers supporting this management measure. It is unknown what the actual response to mandatory catch-and-release tournament formats would be, although there is evidence from the opinion surveys that such a measure (i.e., zero bag limits) would be supported by a majority of billfish anglers who participate in tournaments.

Conclusion

Atlantic billfish tournaments are currently moving toward alternative means to measure angler success in catching billfish, including observers and video technology, which should

alleviate the pressure to land billfish. The level of fishing mortality associated with billfish tournaments is minimal relative to required reductions in fishing mortality Atlantic-wide.

3.4.3 Gear Restrictions

The following section was originally included under bycatch reduction (Section 3.3.2.1; Gear Modifications) in the draft Atlantic billfish FMP amendment, but since the following measures restrict or identify allowable gear, these actions are more closely aligned with management measures for directed fishing. One of the most effective means to control fishing mortality is to limit gear configurations. The actions considered in this section of the Atlantic billfish FMP amendment focus on gear and fishing techniques designed to minimize the mortality associated with a capture event.

Final Action: Allow the removal of the hook from Atlantic billfish.

Ecological Impacts

Under current billfish regulations, it is prohibited under §644.7 to "fail to release a billfish in the manner specified in §644.21(b)," which states that "a billfish under the minimum size limit caught shoreward of the outer boundary of the EEZ must be released by cutting the line near the hook without removing the fish from the water," or in §644.23, which states that "a billfish harvested by gear other than rod and reel shoreward of the outer boundary of the EEZ must be released in a manner that will ensure maximum probability of survival. A billfish caught by a pelagic longline shoreward of the outer boundary of the EEZ must be released by cutting the line near the hook without removing the fish from the water." Therefore, recreational anglers and commercial fishermen currently must leave the hook in the billfish upon release of the fish, which may reduce short-term and long-term survival rates. There are commercially-available dehooking devices that can be utilized to remove the hook from billfish prior to release. These devices have been effective in other commercial and recreational fisheries, and have been successfully employed on removing hooks from other large fish. The devices are relatively simple to use, and can be operated effectively with only limited experience. However, conditions can be encountered while at sea, by both commercial and recreational vessels, where a billfish can only be released by cutting the fishing gear in the interest of human safety.

As stated previously, the magnitude of post-release mortality is an unknown part of the total mortality equation for billfish. Allowing hooks to be removed from recreational and commercially- caught fish, rather than just cutting the fishing line, may increase the chance of post-release survival, and would provide a precautionary approach to reducing fishing-related mortalities. Proper handling techniques to remove a hooked billfish from commercial or recreational gear will also be included in the outreach programs to enhance the effectiveness of this alternative.

Economic Impacts

The economic impact of this final action may provide for a expanded market for dehooking devices. In addition, allowing removal of the hook from a fish, rather than requiring the line to be cut, will have a positive economic impact by allowing re-use of an expensive lure or commercial pelagic longline hook. A precautionary approach to reducing release mortality could provide long-term benefit in rebuilding billfish resources.

Social Impacts

Allowing an alternative means to release fish will encourage commercial and recreational anglers to take a proactive role in precautionary measures to reduce release mortality.

Conclusion

Although the reductions in release mortality by allowing alternative means to cutting fishing line are unknown, this final action is a precautionary measure that has the potential to reduce release mortality, with no known negative biological, economic or social impacts. The Billfish AP also supported this final action.

Rejected Option: Prohibit use of multiple hooks per bait or lure by recreational Atlantic billfish fisheries

Ecological Impacts

This rejected option was included as a preferred management measure in the draft Atlantic billfish FMP amendment, as a precautionary measure to reduce release mortality. Many verbal and written responses were received during the comment period for the proposed rule voicing concern over the effectiveness of this management alternative. Enforcement of this measure also may be impractical. Prohibition of double hook rigs could limit the ability of billfish anglers to target other recreational species where a double hook rig is allowable (e.g., king mackerel or tuna). After further consideration of this measure, the Atlantic billfish AP also withdrew support for this alternative.

Economic Impacts

The economic impact of this alternative was expected to be minimal, but based on public comment, this assumption may have been incorrect, particularly in areas where a single hook could potentially reduced hook-up or catch rates (e.g., Gulf of Mexico). There will also be some cost to recreational anglers in altering existing multi-hook lures, or purchasing single-hook lures, as well as to fishing tackle manufacturers. Use of this precautionary approach to reducing release mortality could provide long-term benefits in rebuilding billfish resources.

Social Impacts

In the angler opinion section of the study by Fisher and Ditton, the prohibition of double hooks was not well supported, with 53.7 percent disagreeing with this management measure. Ditton and Clark (1994) found similar reactions by billfish anglers in Puerto Rico, with 41.9 percent of residents and 32.2 percent of non-residents opposing the "no double hooks on lures" management option. These results were corroborated by verbal and written responses during the public comment period.

Conclusion

This alternative was rejected as a final management option, but because of its potential value as a precautionary measure to reduce release mortality, use of single-hook rigs, as well as other gear modifications (e.g., circle hooks) will be included in the outreach programs that will be developed as part of a final action under Section 3.8.

Rejected Option: No Action Alternative (Status Quo).

Ecological Impacts

The status quo alternative would provide no additional reductions in fishing mortality, bycatch or bycatch mortality levels for Atlantic billfish; however, the HMS FMP includes several gear modifications as a mechanism to address bycatch concerns as described in Section 3.5.3.2.

Economic and Social Impacts

Taking no action to reduce fishing mortality would allow overfished billfish stocks to decline further through bycatch and bycatch mortality associated with interactions with commercial and recreational gear. This would result in reduced net benefits to society in the long-term. If stocks continue to be overfished, billfish anglers will likely experience a reduction in recreational satisfaction as encounters with target species become less frequent.

Conclusion

This alternative was rejected because it would contribute to continued overfishing and prevent rebuilding within the constraints of the Magnuson-Stevens Act provisions.

Rejected Option: Prohibit the possession and use of any hook but a circle hook in Atlantic billfish recreational fisheries.

Ecological Impacts

This measure is designed to reduce bycatch mortality in a fishery that is increasingly of a catch-and-release nature. Circle hooks are believed to minimize hook damage, thus increasing survival of billfish, and other pelagic species, by hooking a fish in the jaw rather than the throat,

stomach, or palate. Circle hooks are already being used to some extent by recreational anglers and in commercial pelagic longline operations. Preliminary results of a study on a limited number of school size bluefin tuna found 100 percent of the samples were hooked in the jaw with circle hooks, while 43 percent were hooked in the jaw using with standard straight hooks (Skomal, pers. comm.). Lines using circle hooks also seemed less prone to break away before the fish was brought to the boat, although a Billfish AP member indicated that use of circle hooks has reduced hook-up rates of blue marlin. Data from a similar study indicate that circle hooks resulted in 100 percent jaw hookings for Atlantic bonito, spiny dogfish, and bluefin tuna, while straight hooks resulted in throat, palate, and "deep" hooking sites (Skomal, pers. comm.). While this information is preliminary, anecdotal evidence from billfish and tuna fishermen indicates that when circle hooks are used, post-release survival is likely to be higher than with straight hooks. The Billfish AP voiced strong support for further research on the effectiveness of circle hooks for commercial and recreational use (see Section 1.4).

Economic and Social Impacts

This alternative would prohibit the possession of any hook other than a circle hook onboard any recreational Atlantic billfish vessel. This prohibition would impact recreational anglers targeting species other than Atlantic billfish during the same trip (e.g., a trip for dolphin or wahoo might also yield an Atlantic billfish). Allowing only the use of circle hooks would be relatively easily enforced by dockside and at-sea vessel inspections. This alternative might benefit Atlantic billfish stocks by increasing post-release survival of Atlantic billfish.

The cost of circle hooks is comparable to the cost for other types of commonly used hooks in the Atlantic billfish recreational fishery. However, fishery participants may not support this alternative as it would require discarding all other types of hooks, including fly-fishing gear which has become increasingly popular. Fly-fishing gear may extend the fight and increase post-release mortality rates of billfish. This alternative represents a capital expenditure that is minor considering other expenditures in this fishery. This alternative may represent an impact to hook manufacturers. It is evident that more straight "J" hooks are currently sold to recreational Atlantic billfish fishermen. Hook manufacturers may not be able to produce or market circle hooks effectively enough to recoup any losses prompted by this alternative. However, tackle shops and hook manufacturers are exploring the possibility of mass producing circle hooks that would have properties acceptable to Atlantic billfish and other HMS recreational fishery participants.

Conclusion

Further research is required on the impacts of circle hooks relative to hook-up rates, release mortality and hook design before the use of circle hooks can be mandated for the recreational billfish fishery. However, the use of circle hooks will be included in the outreach programs for commercial recreational anglers established in the fifth final action discussed in Section 3.8 (Monitoring, permitting and reporting).

Figure 3.4.1. Reported Atlantic blue marlin recreational landings and commercial discards from 1980 to 1996 by the United States (SCRS, 1996b).

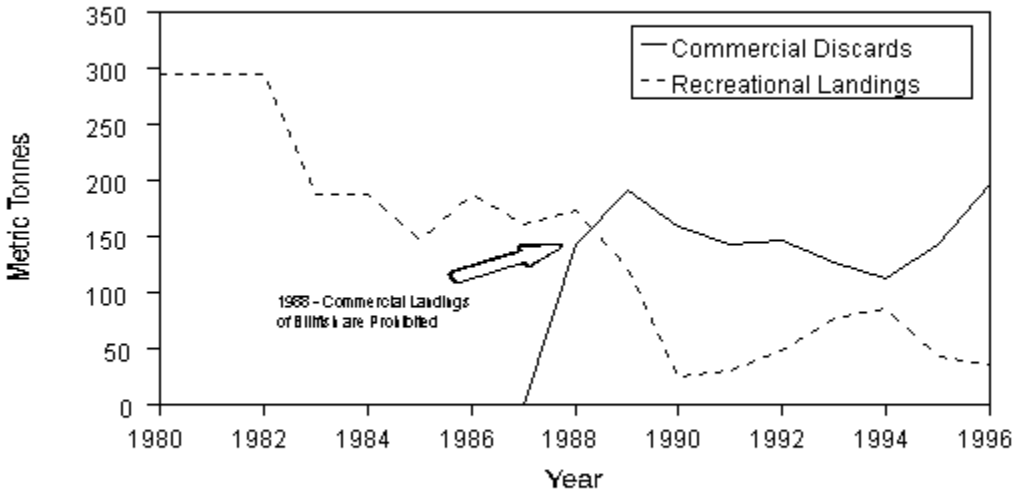


Figure 3.4.2. Reported Atlantic white marlin recreational landings and commercial discards from 1980 to 1996 by the United States (SCRS, 1996b).

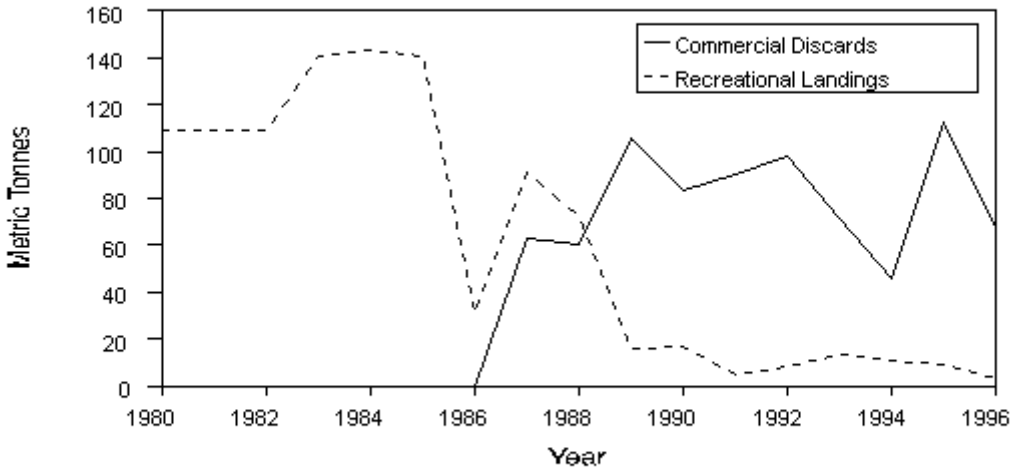


Figure 3.4.3. Size frequency (inches LJFL) distribution for Atlantic blue marlin landed during billfish tournaments between 1995 to 1997 (N=503 fish).

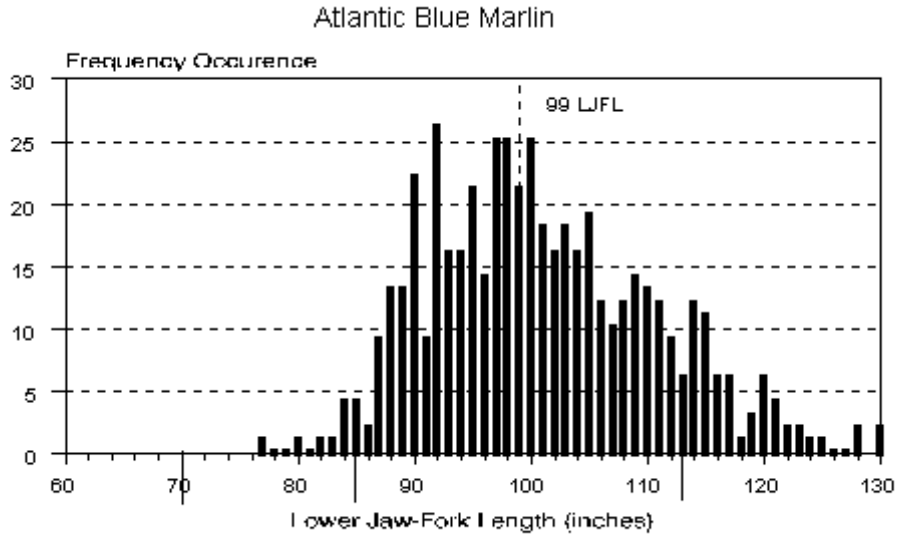


Figure 3.4.4. Size frequency (inches LJFL) distribution for Atlantic white marlin landed during billfish tournaments between 1995 to 1997 (N=127 fish).

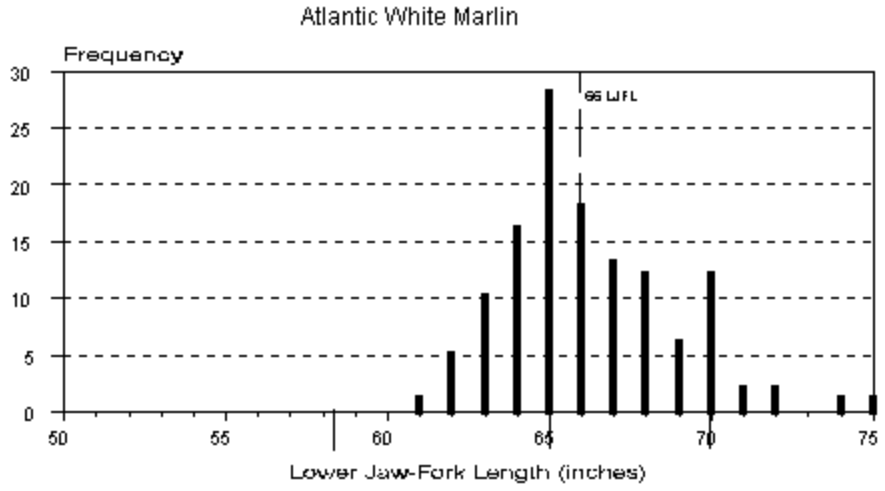


Figure 3.4.5. Size frequency (inches LJFL) distribution for west Atlantic sailfish landed during billfish tournaments between 1995 to 1997 (N=115 fish).

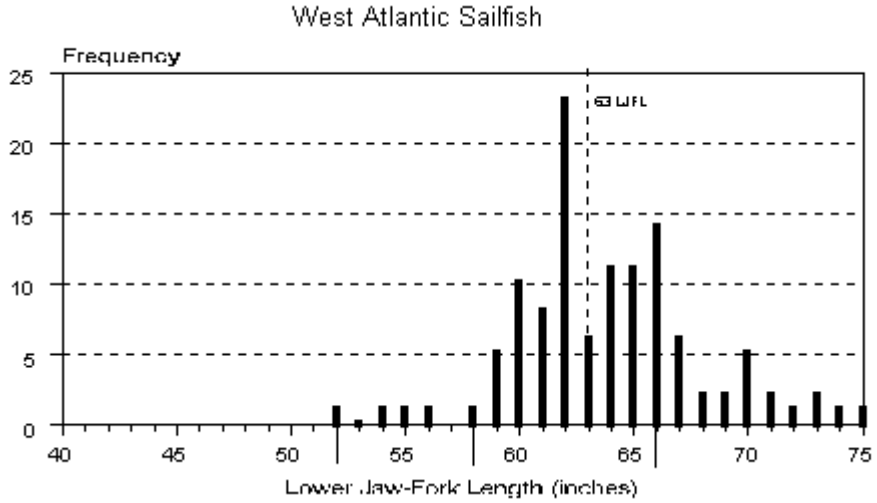


Figure 3.4.6. Cumulative percentage distribution (by 1 inch LJFL increments) for Atlantic blue marlin landed during billfish tournaments between 1995 to 1997 (N=503 fish).

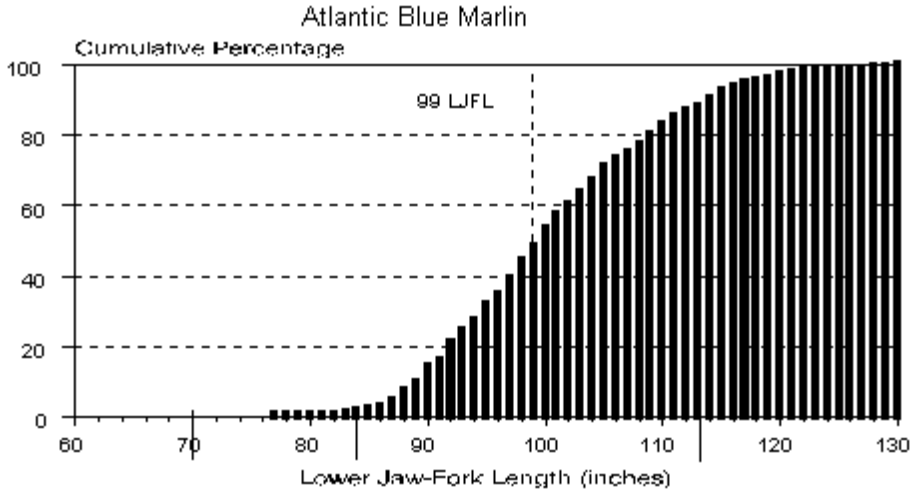


Figure 3.4.7. Cumulative percentage distribution (by 1 inch LJFL increments) for Atlantic white marlin landed during billfish tournaments between 1995 to 1997 (N=115 fish).

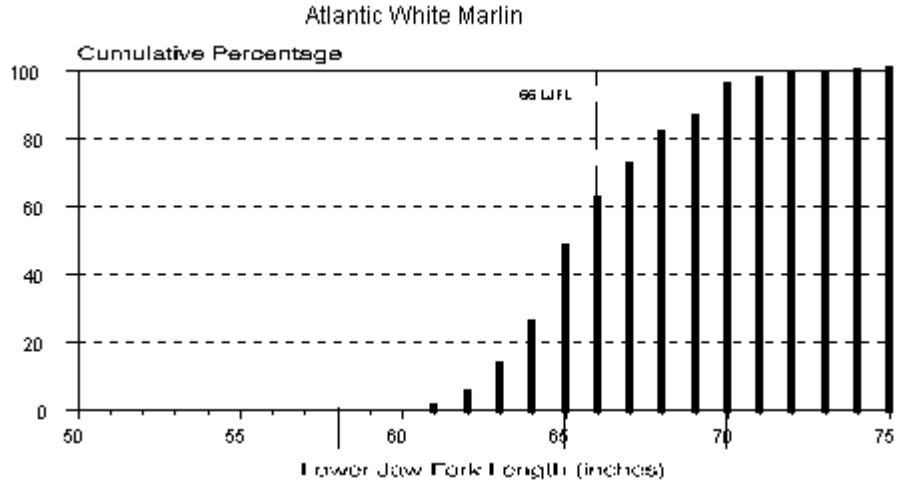


Figure 3.4.8. Cumulative percentage distribution (by 1 inch LJFL increments) for west Atlantic sailfish landed during billfish tournaments between 1995 to 1997 (N=115 fish).

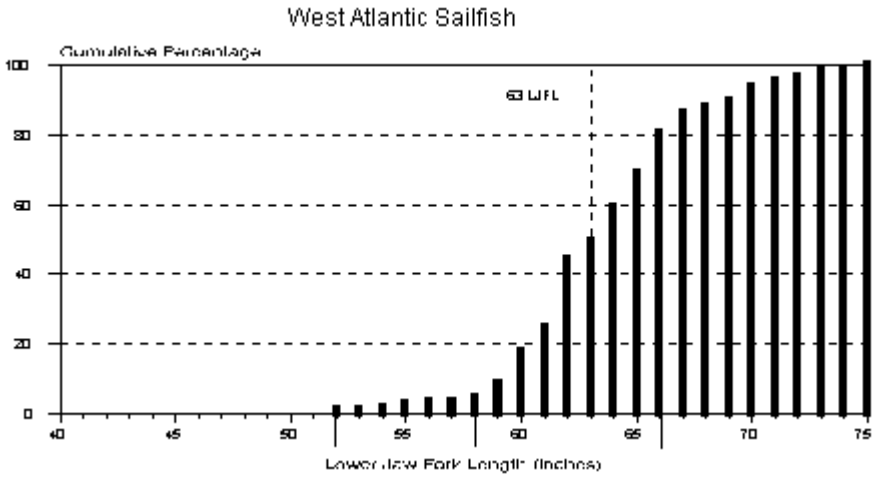


Table 3.4.1. Projected reductions in landings of Atlantic blue marlin resulting from various minimum size limits.

Size Limit	Number blue marlin landed between 1995 to 1997 (total sample size = 503)	Projected reduction in landings (percent) by weight
96	344	21.6
97	330	23.9
98	305	28.0
99[2]	280	32.4
100	257	36.1
105	166	54.2
110	66	70.1
115	47	84.1
120	20	92.5

Table 3.4.2. Projected reductions in landings of Atlantic white marlin resulting from various minimum size limits.

Size Limit	Number white marlin landed between 1995 to 1997 (total sample size = 127)	Projected reduction in landings (percent) by weight
65	95	22.3
66[1]	67	42
68	36	65.9
69	24	76.5
70	18	81.8
72	4	95.2

[2]Current minimum size limit included in the September 24, 1998 interim rule and Atlantic billfish FMP amendment.

Table 3.4.3. Projected reductions in landings of west Atlantic sailfish resulting from various minimum size limits.

Size Limit	Number sailfish landed between 1995 to 1997 (total sample size = 115)	Projected reduction in landings (percent) by weight
60	105	5.9
61	95	11.9
62	87	17.4
63	64	35.4
64	58	39.3
65	47	54.6

Table 3.4.4. Number of longbill spearfish tagged, by year, as a percentage of the total number of billfish tagged as part of the Cooperative Tagging Center (NMFS 1997)

Year	Total Number Billfish Tagged	Number of Spearfish	Spearfish Percentage of Total
1988	5,306	12	0.23
1989	5,448	14	0.26
1990	6,717	20	0.30
1991	6,569	29	0.44
1992	6,658	22	0.33
1993	6,079	51	0.84
1994	3,862	29	0.75
1995	3,542	20	0.56
Total	44,181	197	0.44

Table 3.4.5. Preliminary results of the north Gulf of Mexico (St. Petersburg, FL, to South Padre Island, TX) Recreational Billfish Survey for 1996 and 1998 (preliminary data). In 1996, total hours fished was 19,467 hours and in 1998, 18,077 hours.

Species	Year	Minimum Size (inches LJFL)	Boat[1]	T&R[2]	Caught[3]	Lost[4]	Hooked[5]	CPUE[6]	HPUE[7]
White Marlin	1996	62	23	92	115	153	268	0.6	1.4
	1998	66	4	110	114	125	239	0.6	1.3
Blue Marlin	1996	86	51	217	268	337	605	1.4	3.1
	1998	96/99[8]	22	119	141	191	332	0.8	1.8

[1]Number of billfish that were brought back to the dock.
[2]Number of billfish that were tagged and released.
[3]Number of billfish that were caught, which is equal to number boated added to the number tagged and released.
[4]Number of billfish that were hooked on recreational fishing gear and identified to species, but are broken off before reaching the boat.
[5]Total number of billfish hooked, including fish that were lost, tagged and released, and landed.
[6]Catch-per-unit-effort: The number of billfish that were caught (i.e. tagged and released or boated) per 100 hours of fishing effort.
[7]Hook-per-unit-effort: The number of billfish that were hooked per 100 hours of fishing effort.
[8]A March 24, 1998 interim rule (63 FR 14030) increased the minimum size for Atlantic blue marlin to 96 inches LJFL and for white marlin to 66 inches LJFL. On September 29, 1998 (63 FR 51859), the March 24, 1998, interim rule was extended for an addition 180 days, including an increase in Atlantic blue marlin minimum size to 99 inches LJFL.

Table 3.4.6. Evaluation of the effectiveness of the interim measures to reduce Atlantic white marlin and Atlantic blue marlin during 1998 in the north central Gulf of Mexico.

Species	Year	Boated	Caught	Percent Boated/ Caught	Retention Rate (Percent) Decrease from 1996[1]
White Marlin	1996	23	115	20.0	
	1998	4	114	3.51	82.4
Blue Marlin	1996	51	268	19.03	
	1998	22	141	15.60	18.02
	1998[2]	17	141	12.06	36.6

[1]The retention rate was calculated as the percent change in number of fish landed relative to the number of fish caught during 1996 vs. 1998. Although the ICCAT recommendation is 25 percent reduction in landings, which are reported in weight, the values in this table represent changes in numbers of fish landed.

[2]In March 24, 1998, an interim rule raised the minimum size for blue marlin from 87 to 96 inches LJFL; on September 29, 1998, the minimum size of blue marlin was further increased to 99 inches LJFL. This change occurred following the blue marlin season in the Gulf of Mexico (Figure 3.8.1). A total of 5 of the 22 fish landed during 1998 were between 96 and 99 inches LJFL, therefore, to fairly evaluate the impact of the 99 inch LJFL minimum size utilized in the FMP amendment, these five fish were removed from the analysis, yielding a 41.2 percent reduction in retention rate of Atlantic blue marlin, relative to 1996 levels.

3.5 A Strategy for Bycatch Reduction in HMS Fisheries

3.5.1 Introduction

The final Atlantic billfish FMP amendment approaches the issue of bycatch using a strategy that functions in concert with the operational paradigms of the fisheries that interact with these species. In that regard, the FMP amendment identifies two distinct elements where Atlantic billfish are encountered, a recreational angling component (including private and charter vessels), and an HMS commercial fishery component. In recognition of the fact that the recreational and commercial sectors function differently, with distinctive objectives, the FMP amendment subsequently reflects these operational constraints. The 1988 FMP reserved the Atlantic billfish resources within the U.S. EEZ for recreational anglers, therefore, this FMP amendment includes measures that regulate the recreational fishery. Conversely, the HMS FMP will be the primary tool for designing, analyzing and implementing management measures to control bycatch in association with all HMS commercial fisheries, including Atlantic billfish. This approach follows similar strategies utilized by NMFS to manage bycatch in other fisheries (e.g., juvenile red snapper bycatch in shrimp trawls is regulated through Amendment 9 of the Gulf of Mexico Shrimp Fishery FMP).

The Atlantic billfish FMP amendment begins by defining bycatch in terms of the Magnuson-Stevens Act and the NSGs, as well as bycatch requirements under the MMPA and ESA. The FMP amendment then provides a quantitative review of Atlantic billfish bycatch and associated caveats. This section is followed by an examination of the pertinent elements of the HMS FMP bycatch reduction plan (Section 3.5.3), and culminates this discussion with the formulation of an Atlantic billfish bycatch reduction strategy (Section 3.5.3.3), including an evaluation of progress toward measurable reductions in billfish bycatch as part of the annual SAFE report. The overarching goal of this multi-dimensional approach to reduce Atlantic billfish bycatch and bycatch mortality to the maximum extent practicable, within the framework of the applicable sections of the Magnuson-Stevens Act and ATCA, the biology of the species, and the practical functioning of these fisheries (including social and economic impacts).

Bycatch has become a central concern of fishing industries, resource managers, scientists, and the public, both nationally and globally. A 1994 report of the Food and Agriculture Organization (FAO) of the United Nations estimated that the nearly one-quarter (27 million metric tons) of the total world catch by commercial fishing operations was discarded (Alverson *et al.*, 1994). Bycatch from recreational fisheries was not quantified in the FAO report, but anglers also discard millions of fish each year (NMFS,1998). Bycatch can result in death or injury to the discarded fish, and it is essential that this component of total fishing-related mortality be incorporated into fish stock assessments and evaluation of management measures.

Bycatch precludes other more productive uses of fishery resources; it is important to minimize the waste associated with bycatch when so many of the world's fisheries are either fully exploited or overexploited. Although not all discarded fish die, when bycatch becomes a source of fishing mortality it can slow the rebuilding of overfished stocks. Bycatch imposes

direct and indirect costs on fishing operations by increasing sorting time and decreasing the amount of gear available to catch target species. Bycatch concerns also apply to populations of marine mammals, sea turtles, seabirds and other components of ecosystems for which there are no commercial or recreational uses.

There are many benefits associated with the reduction of bycatch, including the reduction of uncertainty concerning total fishing-related mortality, which improves NMFS' ability to assess the status of stocks, to determine the appropriate optimum yield and to ensure that overfishing levels are not exceeded. NMFS is committed to working with fishery constituents through a flexible, effective bycatch strategy to support rebuilding overfished stocks and maintain sustainable fisheries. This strategy includes a combination of management measures in the directed fishery and the commitment to seek bycatch reduction stock-wide through multi-lateral measures at ICCAT. The effectiveness of the bycatch reduction measures will be evaluated annually as part of the SAFE report for Atlantic billfish and HMS fisheries.

3.5.1.1 National Standard 9

National Standard 9 requires that fishery conservation and management measures shall, *to the extent practicable* (emphasis added): (1) Minimize bycatch; and (2) To the extent bycatch can not be avoided, minimize the mortality of such bycatch (part 600.350(a)). The Magnuson-Stevens Act defines bycatch as:

> fish that are harvested in a fishery, but are not sold or kept for personal use, and includes economic discards and regulatory discards. [Bycatch] does not include fish released alive under a recreational catch and release fishery management program.

Some examples of fish that are included in the Magnuson-Stevens Act's definition of bycatch are Atlantic billfish caught and discarded by commercial fishing gear (unless they are tagged and released alive); undersized swordfish and tunas; species that cannot be marketed and are discarded, such as blue sharks and hammerhead sharks; and recreationally caught tunas, billfish, swordfish, and most sharks that are not landed (including fish hooked and lost, or fish released at the boat – whether or not the fish was tagged). A recreational catch and release fishery management program is one in which the retention of a particular species caught with recreational fishing gear is prohibited (63 FR 24235; May 1, 1998).

Some examples of HMS that would not be considered bycatch are white sharks caught in recreational fisheries because that fishery is, by regulation, a catch and release fishery only, and billfish and tunas that are caught, tagged, and released by commercial fishing vessels. Bycatch also does not include Atlantic highly migratory species harvested in a commercial fishery that are not regulatory discards and that are tagged and released alive under a scientific tag-and-release program established by the Secretary. This provision applies to billfish and BFT that are caught by longline vessels and released alive under the Southeast Fisheries Science Center's Cooperative Tagging Center (CTC).

NMFS has evaluated all final actions in the HMS FMP, and Atlantic billfish FMP amendment in terms of their effect on the amount and type of bycatch according to the following criteria: impacts on affected stocks; incomes accruing to participants in the directed fisheries in both the short and long term; incomes accruing to participants in fisheries that target the bycatch species; environmental consequences; non-market values of bycatch species, which include non-consumptive uses and existence values; and impacts on other marine organisms. NMFS has also analyzed the extent to which further reductions in bycatch are practicable, taking into account the following factors: effects on the populations of bycatch species; effects on potential other species in the ecosystem, including marine mammals, sea turtles, and birds; changes in fishing and marketing costs; changes in fishing practices; effects on research, administration, and enforcement costs; impacts on management effectiveness; changes in the economic, social, or cultural value of fishing activities and non-consumptive uses of fishery resources; changes in the distribution of benefits and costs; and social impacts.

3.5.1.2 Bycatch Reduction and the Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 (MMPA) is the principal Federal legislation that guides marine mammal species protection and conservation policy. Under requirements of the MMPA, NMFS produces an annual List of Fisheries that classifies domestic fisheries, by gear type, relative to their rates of incidental mortality or serious injury of marine mammals. The List of Fisheries includes three classifications:

- Category I fisheries are those with frequent serious injury or mortality to marine mammals (longline);

- Category II fisheries are those with occasional serious injury or mortality (SE Shark gillnet); and

- Category III fisheries are those with remote likelihood of serious injury or mortality to marine mammals (Charterboat rod and reel, purse seine, harpoon).

Fishermen participating in Category I or II fisheries are required to be registered under the MMPA and are required, upon request, to accommodate an observer aboard their vessels. Vessel owners or operators, or fishers, in the case of nonvessel fisheries, in Category I, II, or III fisheries must report all incidental mortalities and injuries of marine mammals during the course of commercial fishing operations to NMFS Headquarters. There are currently no regulations requiring recreational fishermen to report takes, nor are they authorized to have incidental takes (i.e., they are illegal). NMFS does require reporting and authorize takes due to charterboat fishing, no reports have been submitted to NMFS to date.

In 1995, the reauthorization of the MMPA established the Take Reduction Team (TRT) process which allows development of Take Reduction Plans (TRPs) for Category I and II fisheries. Take reduction teams are made up of individuals who represent the span of interests affected by the strategies to reduce takes, including commercial and recreational fishing

industries, fishery management councils, interstate commissions, academic and scientific organizations, state officials, environmental groups, Native Alaskans or other Native American interests, if appropriate, and NMFS representatives. The immediate goal of a take reduction plan is to reduce, within 6 months of its implementation, the incidental take of affected marine mammal stocks to below their PBR. The long term goal of a take reduction plan is to reduce, within 5 years, the incidental take of marine mammals to insignificant levels approaching zero mortality and serious injury rates. TRPs are adopted by consensus and forwarded to the Secretary of Commerce with recommendations for implementation.

3.5.1.3 Bycatch Reduction and the Endangered Species Act

The Endangered Species Act (ESA) is the primary federal legislation governing interactions between fisheries and species whose continued existence is threatened or endangered. Through a consultative process, the ESA allows federal agencies to evaluate proposed actions in light of the impacts they could have on these ESA-listed species. In the case of marine fisheries, NMFS consults with its own Office of Protected Resources to determine what impacts major fishery management actions will have on endangered populations of marine species and what actions can be taken to reduce or eliminate negative impacts. Under the Section 7 consultative process, NMFS issues a Biological Opinion (BO) which outlines expected impacts of the proposed action and specifies terms and conditions which must be met to mitigate impacts on ESA-listed species.

In the recent past, NMFS has been operating under conditions of the Biological Opinion that include reasonable and prudent alternatives for avoiding the likelihood of placing an endangered species in jeopardy. Other terms and conditions result from an Incidental Take Statement for sea turtles. In response to the current Incidental Take Statement (May 29, 1997), NMFS did not reopen the driftnet swordfish fishery in August 1998, despite the fact that the entire quota was not taken. Further, NMFS proceeded to prohibit the use of pelagic driftnets in the swordfish (January 1999) and tunas fisheries (the HMS FMP). NMFS also requires 5% observer coverage for pelagic longline vessels, and 100 percent observer coverage for shark gillnets during right whale season, 74 shark gillnet sets annually covered April 1-November 14 (of which half must be outside right whale season), convene educational workshops to begin September 1998, convene a workgroup (cetacean release and avoidance, turtle release techniques) to evaluate potential management actions to reduce sea turtle takes, distribute turtle release techniques, evaluate observer coverage for adequacy of protected resources, implement limited access.

3.5.2 Evaluation and Monitoring of Bycatch

3.5.2.1 Introduction

The identification and quantification of Atlantic billfish as bycatch is a vital component in reducing bycatch and bycatch mortality. The first step in a bycatch management program is to assess what information is available on bycatch and bycatch mortality, and what information needs to be collected to more effectively evaluate bycatch issues that affect HMS and Atlantic billfish stocks. A summary of available information on discards from various components of HMS and Atlantic billfish fisheries is provided in Table 3.5.1. The Atlantic tunas purse seine, harpoon, and rod and reel commercial fisheries have not been monitored regularly in the past to collect bycatch data. Their finfish discard rates are thought to be low and are not currently estimated by NMFS. In 1996, the purse seine fishery had 100 percent observer coverage which provided data on discard rates of marine mammal and tunas, however, this observer coverage is not ongoing. NMFS has the authority to select tuna vessels for collection of logbook and observer data.

Pelagic longline dead discard estimates for Atlantic billfish, swordfish, billfish, large coastal sharks and pelagic sharks are made using data from pelagic logbook reports and NMFS observer reports. Bycatch estimates for the pelagic longline fishery utilize models that derive data from both observer and logbook records. (For more information, refer to Cramer and Adams, 1998). Pelagic driftnet, coastal driftnet, and shark gillnet discard estimates could be extrapolated from logbook data and NMFS observer reports. Documentation of discards from longline gear were first collected in 1986.

Rod and reel catch estimates from VA to Maine during June through October can be monitored through expanding survey data derived from the Large Pelagic Survey, however, these estimates are not currently available. Catch estimates of rod and reel data can also be estimated through analysis of tournament reports. Swordfish harpoon discard estimates have not been analyzed. NMFS has limited observer data from these trips but harpoon fishermen are required to submit logbooks and NMFS will assemble that data in the near future.

3.5.2.2 Atlantic Billfish Bycatch and Bycatch Mortality

As a source of fishing mortality, excessive bycatch in commercial fisheries can slow rebuilding of overfished stocks (if most of the bycatch dies) and imposes direct and indirect costs on commercial fishing operations by increasing sorting time, and decreasing the amount of gear available to catch target species. However, the relative magnitude and frequency of encounters of Atlantic billfish with pelagic longline gear (responsible for most of the commercial bycatch of billfish) must be considered in developing practical management decisions. In 1995, billfish represented a total of 1.26 percent of the pelagic longline catch (Table 2.1.5; Atlantic blue marlin - 0.49 percent; Atlantic white marlin - 0.49 percent; west Atlantic sailfish - 0.2 percent; and longbill spearfish - 0.07 percent). A total of 69.2 percent of these billfish were released alive (Table 2.1.2; blue marlin - 74.4 percent; white marlin - 68.8 percent; west Atlantic sailfish - 58

percent; and longbill spearfish - 64.7 percent). The survival rate of billfish on pelagic longline gear is validated by results from a study by Berkeley and Edwards (1997), stating that 20 to 75 percent of billfish were alive after 12 hours after being hooked (Figure 3.5.1). After accounting for live releases, the effective billfish fishing mortality (i.e., discarded dead) was 0.4 percent of the total pelagic longline catch (blue marlin - 0.12 percent; white marlin - 0.15 percent; west Atlantic sailfish - 0.08 percent; and longbill spearfish - 0.03 percent).

A total bycatch mortality impact of pelagic longline gear can not be determined since the release mortality is unknown for the hooked billfish fish that are released alive. Catch and dead discard rates for Atlantic billfish from pelagic longline gear follow the general abundance trends for billfish populations, tending to be higher in the Gulf of Mexico, the Atlantic Florida coast and Caribbean Sea than in more northerly waters (Table 2.1.5). Commercial fishers have an incentive to avoid billfish when possible, since they are prohibited by law from retaining, landing or selling billfish in the U.S. EEZ. For each billfish caught by a longline vessel, a hook is used, and therefore unavailable to catch other pelagic fish that may be landed, retained, and sold. The distributional patterns and extensive range of billfishes confound effort to identify specific time and/or locations (i.e., "hot spots"), when and where relatively more Atlantic billfish are captured by pelagic longline gear. The quarterly distribution of Atlantic billfish catch (in numbers of fish) from pelagic logbook reports for 1995 are summarized, by area, in Table 3.5.2. NMFS will also continue to monitor bycatch of Atlantic billfish in other commercial fisheries (e.g., tile fish, squid trawls) to ensure all sources of mortality are minimized.

Atlantic billfish are generally solitary, oceanic and wide-ranging species, although sailfish have been found in small schools in warm coastal waters (see Section 4.3). These behavioral patterns make recreational billfish fishing a relatively rare event. Voluntary conservation actions have proliferated in the Atlantic billfish angling community through the efforts of constituent organizations (e.g., CCA, TBF), local billfish clubs, and sport fishing magazines. As a result recreational anglers are not only releasing fish below the minimum size (as required by law), but more importantly, anglers are also releasing that could legally be retained. Release rates range from 74 to 99 percent (Table 2.1.3, and Fisher and Ditton, 1992), depending on area, with many of the released fish being tagged as part of the NMFS Cooperative Tagging Center (CTC) program (Jones *et al*., 1997). Fisher and Ditton (1992) found that retention rates for billfish tournament anglers in 1989, on a per angler basis, ranged from 0.35 billfish/year in the mid-Atlantic to 2.87 billfish/year in the Caribbean, averaging 0.68 billfish/year across all Atlantic-based recreational billfish fisheries (Table 2.1.7).

The reduction of bycatch mortality is an important component of NS 9. Physical injuries may not be apparent to the angler or commercial fishermen who is quickly releasing a fish. Results from a recent study indicate that immediate fishing mortalities in hook and line caught juvenile bluefin tuna can be substantial (29.2%) due to injuries or predation (Belle, 1997). This is likely to be a conservative estimate because scientific personnel in the study were professionally trained and had extensive experience in fish handling techniques designed to reduce mortality. Mortality often occurs 10 minutes or longer after the fish is released under normal circumstances. Injuries may not be readily apparent to the angler and seemingly minor

capture injuries may be related to substantial internal injuries. Forty percent of sampled tuna that died during that study did not have injuries that would be apparent to the angler in the boat. Skomal and Chase (1996) provide evidence that the extreme stress of rod and reel angling did not cause immediate post-release mortality in larger BFT (50-150 kg). However, they do document metabolic and pH disturbances in BFT sampled off of Hatteras, NC. The physiological consequences of angling stress are poorly understood for several species of large pelagic fishes (Skomal and Chase, 1996). A summary of recent studies on HMS bycatch mortality associated with releasing hooked fish is provided in Table 3.5.3.

3.5.2.3 Summary of Bycatch Issues

NMFS intends to minimize bycatch of HMS in all fisheries, to the extent possible, through actions included in the HMS FMP. NMFS also intends to minimize bycatch of other finfish, marine mammals, sea turtles, and sea birds, in HMS fisheries. The following issues are currently identified as particular bycatch concerns (not in any specific order):

- Dead discards of bluefin tuna in the pelagic longline fishery
- Bycatch of undersized swordfish in the pelagic longline fishery
- Bycatch mortality of released HMS, including Atlantic billfish, in all fisheries
- Bycatch of juvenile sharks in all fisheries
- Bycatch of marine mammals in the pelagic longline fishery
- Bycatch of sea turtles in the pelagic longline fishery

In addition, NMFS continues to monitor, collect and assemble data, and develop strategies to reduce bycatch of HMS in other fisheries, as well as minimize interactions with protected species in HMS fisheries.

3.5.3 Reducing Atlantic Billfish Bycatch and Bycatch Mortality

The issue of bycatch of Atlantic billfish in commercial pelagic longline fisheries, and the designation of billfish released by recreational anglers as bycatch in the draft FMP amendment, generated a large number of written and verbal responses during the public comment period for the proposed rule implementing the preferred management measures in the draft Atlantic billfish FMP amendment. The following section specifically addresses these comments in terms of partitioning bycatch management. The HMS FMP will be the primary tool for designing, analyzing and implementing management measures to control bycatch, including bycatch, in association with all HMS commercial fisheries. The Atlantic billfish FMP amendment specifically manages mortality from the recreational angling sector.

Final Action: Establish an Atlantic billfish bycatch reduction strategy.

Ecological Impacts

The final action establishes a specific bycatch reduction strategy for Atlantic billfish which is implemented through actions contained in the HMS FMP to regulate where and when fishing occurs in this FMP amendment, with allowable fishing gear and practices to minimize bycatch and maximize bycatch survivability, to the maximum extent practicable. As required by NS9, the goal of this strategy is to reduce bycatch to the maximum extent practicable, which will be accomplished through six elemental components to effectively reduce effort and longline bycatch mortalities:

1. *Time-area closures*. This portion of the Atlantic billfish bycatch reduction strategy replaces the time-area alternatives included in the draft FMP amendment. The preferred alternative was status quo, with another alternative that set a target level of 25 percent reduction in Atlantic billfish bycatch in the pelagic longline fleet. The Billfish AP and many public comments supported development of time-area closures to reduce pelagic longline bycatch by at least 25 percent. Although the final action does not set a specific target, reduction of Atlantic billfish commercial bycatch is now included in the HMS FMP, which will be the primary tool for designing, analyzing and implementing time-area management measures that impact Atlantic billfish. The HMS FMP includes a final action to develop a proposed rule to increase the effectiveness of the rejected Florida Straits time-area closure strategy. NMFS has scheduled a combined HMS and Billfish AP meeting for June 10-11, 1999 to discuss the results of new analyses that NMFS is undertaking. After that discussion, NMFS will select a preferred alternative and publish a proposed rule under the framework of the HMS FMP.

Goodyear (1998) examined logbook data to determine the distribution of relative commercial pelagic longline catch rates of billfish (total billfish complex, as well as just the marlins) and target species (generally swordfish and tunas) by 1, 2, and 5 degree areas and months to identify potential time-area strata that could reduce billfish bycatch. The areas examined were limited to the operational limits of the U.S. pelagic longline fleet, which includes a large area outside the U.S. EEZ. Logbook records from 1986 to 1991 were utilized (as

reported) to identify relatively higher occurrences (in time and space) of billfish/marlin in pelagic longline catches. Goodyear was able to identify a suite of time-area cells that would result in a 25 percent reduction (a range of 5 to 95 percent reductions were considered; Table 3.5.5) in billfish bycatch, with corresponding decrease in target catch of 4.2 percent, 5.6 percent or 7.2 percent, depending upon the spatial resolution used (i.e., 1, 2 or 5 degree blocks, respectively). A similar level of marlin bycatch reductions could be achieved with a resultant 5.1 to 8.6 percent decline in target species catch throughout the range of the pelagic longline effort in the Atlantic Ocean. The temporal and spatial stability of a 50 percent reduction in bycatch through time-area closures was tested against the 1992 to 1995 logbook data. The combined billfish model resulted in reductions in billfish and target species that averaged less than predicted values. Reductions for marlin were less than the predicted amount and the reduction for the target species was slightly greater than the predicted value.

Although the results of Goodyear's study demonstrate that time-area closures could be effective in reducing billfish bycatch in commercial fishing gear, there are some additional points that must be considered. The Goodyear study did not account for redistribution of pelagic longline effort to other open time-area cells; however, his more recent report on the Florida Strait closures, as discussed previously shows that effort redistribution can impact billfish bycatch rates. Billfish are sparsely distributed over vast ocean areas, therefore shifting commercial efforts could result in similar, or perhaps even higher billfish encounter rates. A higher billfish bycatch rate may be of particular concern if swordfish pelagic longline fishermen re-rig their gear to target dolphin (mahi mahi), which is a daytime fishery that offers a greater potential for billfish bycatch. Another point is the spatial distribution of the closed areas, which ranged from the Grand Banks, along the east U.S. coast, Gulf of Mexico and Caribbean. Many of these areas are outside the U.S. EEZ where other countries also operate commercial longline fleets. Closure of these areas could disadvantage U.S. fishermen, which would violate Magnuson-Stevens Act and ATCA provisions. Further research is needed to develop a workable time and area closure strategy to reduce Atlantic billfish bycatch (see Section 1.4).

2. *Limited access* - Limited access in the swordfish pelagic longline fishery is being implemented as part of the final HMS FMP. Limited access is an important first step toward rationalization of fisheries. A permit limitation program restricts access to a fishery by limiting the number of fishermen allowed to harvest the resource, and is an important part of reducing effort which will result in a decrease in billfish bycatch and mortality.

3. *Reduced quotas* - Restrictions on quota will lead to further reductions in fishing effort, leading to a concomitant reduction in billfish mortality associated with pelagic longline fisheries, if overall pelagic longline effort decreases (i.e., reductions in swordfish quota do not result in increased effort in tuna, dolphin or other pelagic longline fisheries). The HMS FMP identifies a final action to develop a foundation for a reduction in the north Atlantic swordfish quota, and would likely be implemented in 2000, following the 1999 ICCAT meeting. Atlantic billfish are taken as bycatch to pelagic longline swordfish fisheries, therefore, any reduction in quota should translate to a reduction in effort, resulting in fewer billfish mortalities.

4. *Outreach programs* - Outreach programs are included as final actions in the HMS FMP and Atlantic billfish FMP amendment (Section 3.8). One of the key elements of the outreach program will be to provide information that can lead to an improvement in post-release survival from both commercial and recreational fishing gear. The success of any outreach program is predicated on reaching the entire user-group universe, requiring the cooperative efforts of various constituent organizations (Section 7.4), as well as other state and federal agencies.

5. *Gear restrictions* - Scientifically-based studies are needed to determine the impact of various gear types (e.g. circle hooks) and fishing practices (e.g., soak times, length of gear, time of day) on bycatch and bycatch mortality of billfish (Section 1.4). If effective gear measures can be implemented, the number of billfish caught on pelagic longline gear could be reduced, or if they are caught, increase their chance of surviving the capture event.

6. *Buyback programs*. Under the Magnuson-Stevens Act, another potential management tool is a vessel or permit "buyback" program. Buyback programs pay vessel owners to surrender fishing permits and/or withdraw vessels from fishing. This may reduce excess capacity, increase harvesting productivity, and help conserve and manage fisheries. This type of management tool can only be implemented if: 1) the program is shown necessary to prevent or end overfishing, rebuild fish stocks, or achieve significant improvements in the conservation and management of the fishery; 2) there is a fishery management plan that prevents the replacement of fishing capacity removed by the program and establishes a specified or target TAC which triggers closure of the fishery; and 3) the program is cost-effective. Under this type of program vessel owners would be paid to either: 1) surrender their fishing permits and relinquish any claim associated with the fishing permit; or, 2) surrender their fishing permits, withdraw their vessels from fishing, and relinquish any claims associated with the fishing permits and/or vessel. NMFS may consider this option after the rebuilding program proposed in the HMS FMP, including limited access, is established. A buyout program can only be effective in the reduction of billfish bycatch if the overall effort (i.e., number of hooks in the water) is reduced.

The Atlantic billfish bycatch reduction strategy does not establish a specific target for reductions in bycatch from the pelagic longline fishery, or other commercial gear that interact with billfish resources, because an evaluation of the cumulative impacts of final actions that are components of this bycatch strategy must first be completed. In addition, NMFS has evaluated the distribution of Atlantic billfish bycatch from pelagic longline gear and has not been able to identify any “hot spots” where dead discards of Atlantic billfish are concentrated relative to the pelagic longline effort being expended in a particular area. Effort redistribution can further impact bycatch rates, as illustrated by Dr. Goodyear’s analysis; however, that was only one paradigm, other models may result in differential encounter rates. Evaluation of the time-area closures must occur before additional measures are implemented. Another factor that must be considered before setting a bycatch reduction target is the low frequency occurrence of Atlantic billfish relative to total pelagic longline catch levels. Atlantic billfish account for approximately 1 to 1.5 percent of the total pelagic longline catch, and after factoring in the number of fish released alive (estimated by observer coverage), the effective mortality is under 1 percent (Section 3.5.2.2).

The six components of the Atlantic billfish bycatch reduction strategy, as designed, analyzed and implemented through the HMS FMP, will reduce bycatch levels in pelagic longline fisheries to the extent currently practicable. The Atlantic billfish bycatch reduction strategy will be evaluated each year as a vital component of the SAFE report. The annual appraisal will include examination of current programs and research to see if Atlantic billfish bycatch can be reduced further, to the maximum extent practicable. NMFS will incorporate additional measures into the Atlantic billfish bycatch reduction strategy as new information becomes available.

Economic and Social Impacts

The social and economic impact of final actions included in the Atlantic billfish bycatch reduction strategy are discussed in the HMS FMP (i.e., time-area closures, limited access, outreach program and quota reductions), while others are discussed as part of rejected options, pending future consideration (e.g., gear restrictions). The buyback program could provide positive economic incentives for commercial fishermen to reduce pelagic longline effort; however, the social impacts of this action have not been fully assessed. The recreational billfish community will likely support an Atlantic billfish bycatch strategy based on the volume of written and verbal comments received on the draft FMP amendment.

A possible consequence of reduced commercial effort in association with extensive time-area closures (including a total ban on pelagic longline gear, which was supported by many commenters), reduced quotas, limited access and/or buyout programs would likely be an increase in foreign effort to fill the supply of tuna and swordfish historically provided by U.S. commercial fishermen, who are required to discard all billfish caught. Since foreign vessels retain billfish, an Atlantic-wide increase in billfish landings could be a direct result of increased foreign fishing activities. In addition, NMFS must comply with the Magnuson -Stevens Act, that specifies the NMFS must provide fishing vessels of the United States with a reasonable opportunity to harvest any allocation or quota of an ICCAT species that has been agreed to by the United States. As stated in 600.10(e)(4)(iii), "for fisheries managed under an international agreement, Councils (Secretary in this case) must reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States." Therefore, management of billfish resources must also consider the impact on swordfish and tuna fisheries in the development of any time-area closures specifically for reducing Atlantic billfish bycatch from pelagic longline gear. Finally, in preparing any FMP or amendment for Atlantic HMS, NMFS must evaluate the likely effects of conservation and management measures on participants in the affected fisheries, and minimize to the extent practicable, any disadvantage to United States fishermen in relation to foreign competitors.

Conclusion

The establishment of an Atlantic billfish bycatch reduction strategy is a final action of the FMP amendment. The final FMP amendment clarifies the role of the HMS FMP as the sole mechanism to manage bycatch from HMS commercial fishing gear (including pelagic longlines).

A multifaceted bycatch reduction plan takes a holistic approach in complying with NS9 to reduce, to the maximum extent practicable, bycatch of billfish in the pelagic longline fishery. There are no safety at sea concerns relative to this final action.

Final Action: Establish a catch-and-release fishery management program for the recreational Atlantic billfish fishery.

The issue of bycatch and the Atlantic billfish recreational fishery generated much discussion, both in the comment period for the proposed rule and from the Billfish Advisory Panel. In fact, as a result of the discussions of this specific issue with the Panel, an eleventh objective was added to "promote the live release of Atlantic billfish through active outreach and educational programs," which is also consistent with the 1997 ICCAT recommendation to promote the voluntary release of live Atlantic blue and white marlin. The NSGs provide in 50 CFR 600.350(c), "[a] catch and release fishery management program is one is which the retention of a particular species is prohibited." However, this is only an example of management measures which may be used to establish a recreation catch-and-release program.

NMFS recognizes that recreational anglers have voluntarily reduced landings of Atlantic billfish since the 1988 Atlantic billfish FMP, by relying very heavily on catch-and-release. Including Atlantic billfish that are recreationally caught and voluntarily released by recreational fishermen in the definition of bycatch is counterproductive because release of a live fish is a beneficial event. Each released fish provides multiple recreational opportunities and social/economic benefits without adversely impacting the stocks, if and only if the probability of surviving catch and release is high. Based on fishing and handling techniques currently used by recreational anglers, the survival rate is probably in excess of 90 percent. Scientific studies summarized in Sections 3.4.1 and 3.5.2.2 corroborate this estimate of release survival.

Therefore, NMFS is encouraging further catch and release of Atlantic billfish by establishing a recreational catch-and-release fishery management program. The following factors support establishment of a catch-and-release program in the recreational Atlantic billfish fishery: (1) the exclusively recreational nature of the directed Atlantic billfish fishery, (2) the already-existing high rate of release of live fish in this recreational fishery, (3) the high rate (likely in excess of 90 percent) of survival of recreationally caught-and-released fish, and (4) the high economic benefit of each fish caught. Further, NMFS believes that establishing a catch-and-release fishery in this situation will further foster the already existing catch-and-release ethic of the recreational billfish fishermen, thereby increasing release of billfish caught in this fishery.

In addition, the prohibition on possession of longbill spearfish in this FMP amendment (Section 3.4), results in recreationally caught-and-released longbill spearfish (Section 3.4.2) not being bycatch, because the NSGs provide, as an example, that "a catch-and-release fishery management program is one in which the retention of a particular species is prohibited."

Ecological Impacts

Recreational billfish anglers have significantly reduced the number of Atlantic blue and white marlin landed since the late 1980s (Figures 2.1.13 and 2.1.14, respectively). Release estimates of recreationally caught billfish in 1995 ranged from 76.8 percent in the Gulf of Mexico to 99.1 percent along the east coast of Florida and Florida Keys (Table 2.1.8). Public testimony taken during the comment period for the proposed rule indicated that billfish release rates over the past three years have further increased to the point where retention of a billfish has become nearly "socially unacceptable," particularly outside of a billfish tournament. Further, more billfish tournaments are turning to a "no-kill" format. Preliminary results from billfish landings during 1998 appear to corroborate these statements (Table 3.4.5 and 3.4.6). Recreation anglers provide further contributions to conservation by tagging approximately 80 percent of Atlantic blue and white marlin that are released. The recreational billfish fishery has essentially become a catch-and-release fishery. The 1997 ICCAT recommendation included a provision to promote the voluntary release of Atlantic blue and white marlin; U.S. anglers have demonstrated an exceptional willingness to do so, even before this recommendation.

In light of the reduced Atlantic billfish mortalities resulting from the release practices of recreational anglers, as well as the increases in minimum size limits (Atlantic blue marlin - 13 inch increase from 86 to 99 inches LJFL; white marlin - 4 inch increase from 62 to 66 inches LJFL; and west Atlantic sailfish - 6 inch increase from 57 to 63 inches LJFL) that will significantly reduce the number of fish that can be landed (Tables 3.4.1, 3.4.2, and 3.4.3), and in consideration of the 1997 ICCAT recommendation, NMFS establishes a catch-and-release fishery management program for the recreational Atlantic billfish fishery. Although retention of Atlantic billfish is allowable, albeit at very reduced levels due to the increase in size limits, conservation practices of the recreational fishery meet the over-arching intent of the NSGs (which do not have the force and effect of law) to reduce mortality levels of overfished species. If recreational landings begin to increase, as determined from the enhanced monitoring programs outlined in this FMP amendment (Section 3.8), this fishery management program can be eliminated. As a result of the establishment of this Program, all Atlantic billfish that are released alive, regardless of size, are not considered as bycatch, within the constraints of the Magnuson-Stevens Act and the NSGs. This decision is consistent with NS9 and the eleventh objective of this FMP amendment. It is also important to note that mortalities associated with all catch-and-release events must be quantified (Section 1.4), with results included in assessment of the stocks.

Economic and Social Impacts

It is not anticipated that this final action will have any negative economic or social impact on the recreational billfish fishery or on communities where billfish angling is an important component of the local economy. Indeed, establishment of a catch-and-release fishery management program will likely be well-received by the recreational billfish community because it acknowledges their established fishing practices and conservation ethics. Recreational fishing

groups will be an important component of establishing educational outreach programs to minimize release mortality rates associated with the catch-and-release event.

Conclusion

The establishment of a catch-and-release fishery management program for the recreational Atlantic billfish fishery is a final action because it meets the objectives of the FMP amendment, as wells as NS9 and the 1997 ICCAT recommendation. There are no safety at sea concerns relative to this final action.

3.5.4 A Strategy for Future Bycatch Reduction

The identification and quantification of bycatch in HMS fisheries is the first step in identifying bycatch concerns and reducing bycatch and bycatch mortality. NMFS data collection programs includes long-term collection of catch and effort data by gear type and species through observer coverage and self-reporting. NMFS is not prepared to set a target or uncertainty threshold for bycatch reduction at this time. Instead, NMFS has identified the bycatch issues of highest priority and has implemented management measures to address those concerns in this FMP. In the future, NMFS may assess bycatch reduction targets and thresholds, and identify acceptable levels of uncertainty for bycatch estimates. The annual SAFE Report on HMS stocks will evaluate the effectiveness of the bycatch reduction strategy in this FMP. Advanced technology will facilitate future reporting and NMFS will continue to work with fishery participants to improve the quality of data related to bycatch and bycatch mortality (NMFS, 1998).

NMFS will also continue to support research on bycatch reduction management measures, including additional gear modifications. Modifications to increase the selectivity of fishing gear often provide an effective tool for reducing bycatch in all fisheries. HMS currently supports research projects that will help to determine the efficacy of certain gear modifications with respect to bycatch and bycatch mortality. In July 1998, the HMS AP discussed the use of different gear types and gear deployment methods to reduce catch and mortality of non-target species in HMS fisheries. The AP was very interested in gear modifications and encouraged NMFS to continue to support gear modification research and information dissemination to commercial and recreational fishery participants. Most AP members felt strongly that non-regulatory mechanisms would be more effective and more acceptable to the fleets than would be regulations mandating the use of a particular gear type or deployment method. Several AP members noted the importance of educating fishery participants and giving them a stake in fishery conservation actions without creating new regulatory, enforcement, and administrative burdens. The final FMP amendment framework contain provisions to implement gear modification measures as new information becomes available (Section 3.11).

Studies have indicated that discarded catch is often not reported as accurately as landed catch (Cramer *et al*., 1997) In some HMS fisheries, a logbook program may provide better information than a limited observer program for a far-ranging fishery. In other instances, an

observer program can provide important information that logbooks do not such as gear modifications or other catch parameters that are not recorded in logbooks or may not be as accurately reported in logbooks due to the attention of the captain to marketable species, rather than unwanted species. Long-term collection programs to evaluate these management measures are particularly imperative in HMS fisheries, given the temporal and spatial variability of bycatch. Other important areas for future research include studies that investigate post-release survival in recreational and commercial HMS fisheries and models of currently unknown mortality on HMS stocks due to bycatch in other fisheries.

All bycatch estimates have some variability based on the robustness of the data used in calculations. A level of acceptable probability (certainty) could be set to determine the level of confidence that can be placed in the recovery estimates to ensure that bycatch is minimized, to the extent practicable. However, bycatch estimates will continue to be made based on widely varying data sources, that depend on the species of interest and the fishery. Collection of statistically robust data is problematic for wide ranging species that are not subject to fishery-independent sampling. Further, stock-wide bycatch data is not currently available from ICCAT. Discard data submitted to ICCAT for Atlantic tunas and swordfish may be associated with large variance estimates due to differences in national data collection programs. Using the bycatch strategy in this FMP as a platform, NMFS intends to continue to address bycatch concerns at ICCAT, including increasing data collection through observer programs, time/area closures, and gear modifications.

Figure 3.5.1. Estimates of survival time of billfish (upper and lower bounds) on pelagic longline gear (after Berkeley and Edwards 1997)

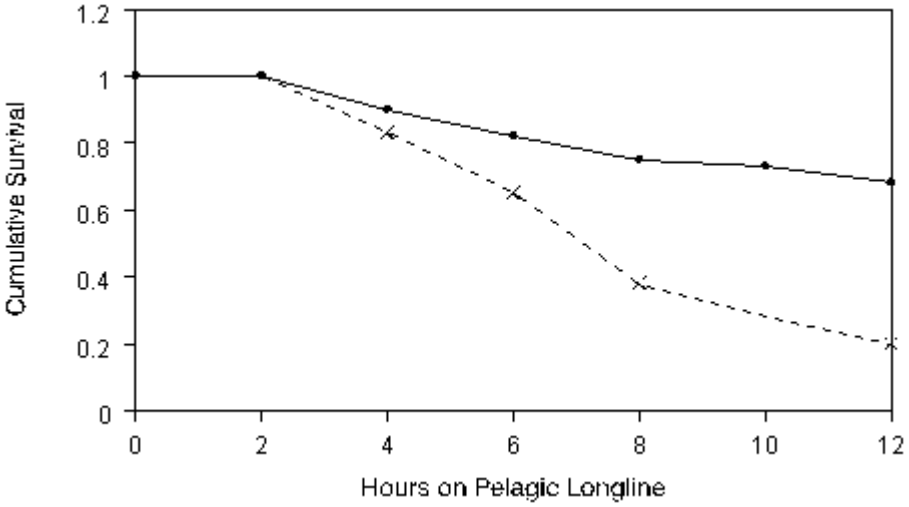


Table 3.5.1 Available Data Regarding Discards in HMS Fisheries

Gear Type	Database	Discard data available ?	DPUE data available ?	Discards	Bycatch and Bycatch Mortality Data Collection Changes in this FMP
Pelagic Longline	Pelagic Logbook Observer data (NMFS)	Yes	Yes (per set or by # of hooks)	Finfish Marine mammals, Sea turtles	None
Bottom Longline (sharks)	Snapper-Grouper Logbook Pelagic Logbook Observer database	Yes	Yes (per set)	Finfish Sea Turtles	None
Coastal Driftnet	Multispecies Logbook Observer database	Yes	Yes	Finfish Marine mammals Sea birds	None; (NMFS is authorized to select these vessels for logbook and observer coverage)
Shark Gillnet	Trent *et al.* study (1993-1995) Observer database (NMFS, beginning 7/1/98)	Yes	Yes (per set)	Finfish Protected species	None
Purse Seine	1996 observer database (NMFS)	Yes	Yes (per set)	Finfish (predominantly tunas); Marine Mammals	None; (NMFS is authorized to select these vessel for logbook and observer reporting)
Commercial Other Tunas	None	No	No	Unknown	Require logbook reporting for charterboats; (NMFS is authorized to select these vessels for logbook and observer reporting)
Harpoon (BFT and swordfish)	None	No	No	*Anecdotal: undersized BFT*	None; (NMFS is authorized to select the BFT vessels for logbook and observer reporting)
Recreational HMS	Tournament database Tagging program LPS (June-Nov., VA-ME); MRFSS (April-Oct, ME-TX)	Yes (finfish only)	Yes (per trip)	Finfish	Require Charter/headboat reporting (NMFS is authorized to select these vessels for logbook and observer reporting)

Table 3.5.2. Distribution of Atlantic billfish catch (number), by quarter and area from the 1995 pelagic corrected longline reports (Cramer, 1996). Quarters are defined as: 1 - January to March; 2 - April to June; 3- July to September; and 4 - October to December.

Location	Quarter	Atlantic Blue Marlin	Atlantic White Marlin	W. Atlantic Sailfish	Longbill Spearfish
Caribbean	1	270	89	10	13
	2	151	76	17	7
	3	115	14	25	5
	4	2	4	0	0
	Total	538	183	52	25
Grand Banks	1	0	0	0	0
	2	2	1	0	2
	3	9	18	0	19
	4	0	0	0	0
	Total	11	19	0	21
Gulf of Mexico	1	39	13	13	0
	2	94	163	224	2
	3	222	191	236	9
	4	56	67	31	0
	Total	411	434	504	11
Northeast Coastal	1	0	4	0	0
	2	26	61	2	0
	3	114	64	12	2
	4	20	100	3	0
	Total	160	808	17	2
Offshore South	1	336	268	53	199
	2	525	317	59	70
	3	8	3	0	1
	4	0	0	17	0
	Total	869	588	129	270

Location	Quarter	Atlantic Blue Marlin	Atlantic White Marlin	W. Atlantic Sailfish	Longbill Spearfish
Southeast Coastal	1	30	18	28	13
	2	136	191	120	6
	3	117	31	88	1
	4	25	18	22	4
	Total	308	258	258	24

Table 3.5.3. Existing information on catch and release mortality.

Study	**Methods**	**Conclusions**
Belle, 1997	catch of juvenile BFT and release into net pen	29% immediate post-release mortality
Skomal and Chase, 1996	catch of large BFT (50-150 kg) and sonic tracking in the wild	0% immediate post-release mortality
Berkeley and Edwards, 1997	GOM Longline catch, hook timers	survival depends on species and length of time fish is hooked before being released
Skomal and Chase, in progress	catch of juvenile BFT and sharks and sonic tracking in the wild	

Table 3.5.4. Estimated dead discards of some highly migratory species in the pelagic longline fishery in 1997 in the area east of the Florida East Coast during the third quarter[3] (Cramer and Adams, 1998).

Species	Number Discarded Dead	Weight of Fish Discarded Dead (lb ww)
Sailfish	209	9,856
Blue marlin	26	3,498
White marlin	0	0
Pelagic sharks	0	0
Blue sharks	0	0
Thresher sharks	26	6,334
Coastal sharks	52	8,549
Dusky sharks	26	2,290
Silky sharks	131	4,919
Hammerhead sharks	183	33,213
Night sharks	183	7,115

[3]This area is larger than the area analyzed for the time/area closure alternative, and therefore represents higher numbers of discards. It is inserted in this text merely to give the reader an idea of the magnitude of small swordfish discards in the general geographic area.

Table 3.5.5. Estimated reductions in billfish and target species by elimination of time-area cells from the operational area of the U.S. pelagic longline fishery (Goodyear 1998)

Billfish %Reduction	1-Degree Cells Target % Reduction	2-Degree Cells Target % Reduction	5-Degree Cells Target % Reduction
5	0.34	0.49	0.94
10	1.01	1.51	2.33
15	1.90	2.73	3.88
20	2.97	4.08	5.52
25	4.25	5.62	7.21
30	5.74	7.54	9.19
40	9.37	12.13	13.68
50	13.87	17.57	19.17
60	19.59	23.72	25.51
70	26.53	30.92	33.13
80	35.30	39.73	42.92
90	47.38	52.09	55.91

3.6 Interim Milestones During Recovery

The following section addresses actions that will be taken to assess recovery progress during the rebuilding period. Stock assessment is the primary tool that will be used to evaluate the progress of stock rebuilding during the recovery period. Managers need to consider how frequently these assessments should be conducted as well as what type of course-correcting action should be taken if recovery is not on schedule.

3.6.1 Stock Assessment Frequency

Assessment of billfish resources by ICCAT's SCRS has previously been performed on an "as needed" basis. The most recent Atlantic marlin stock assessment (third assessment) was completed in 1996; the last west Atlantic sailfish stock assessment was completed in 1992. As a result of the 1998 ICCAT recommendation, the next billfish stock assessment scheduled for 1999 will be delayed until 2000 for Atlantic blue and white marlin, to evaluate the effectiveness of the required 25 percent reduction in landings, and 2001 for west Atlantic sailfish. The level of international coordination required to complete an assessment of billfish resources throughout the Atlantic Ocean (development of data sets, the number of countries involved with landing billfish, and travel limitations) must be considered in relation to reporting frequency needed to adequately track rebuilding progress. Therefore, a full stock assessment should be performed at least every four years. Information on Atlantic billfish landings by the United States would continue to be updated annually through the U.S. National Report.

3.6.2 Management Options Regarding Recovery Trajectories

A wide range of management options will be allowed to promote stock recovery; international efforts will be required to rebuild overfished Atlantic billfish stocks. Modifications to the recovery trajectory and milestones would be made by NMFS in accordance with the guidelines and "triggers" built into the FMP amendment (Sections 3.1, 3.2 and 3.3). If it is determined that the stock is not on its intended recovery trajectory, then immediate corrective action would be required by the agency to return the stock to its recovery course. Milestones would be quantifiable, and would be tied to quantified adjustments to return to the recovery trajectory and included in the framework provisions of this FMP amendment. If recovery were to fall behind schedule, then an adjustment to the fishing mortality rate would be implemented to put the recovery back on track. If recovery was ahead of schedule, fishing pressure could be increased or the additional biomass could be used to provide a buffer to accelerate recovery. The SCRS would be requested to provide analyses, with appropriate confidence limits, as well as information on alternative measures to stay on trajectory. HMS and NMFS would then be responsible for implementing the necessary and appropriate management measures.

3.7 Uncertainty Issues

All metrics used in estimating the recovery trajectories have associated variations based on the robustness of the data used in calculations. The technical guidelines (Restrepo *et al*., 1998) identify three levels of information-richness that will impact the level of uncertainty that can be applied to parameters estimates. Data available for Atlantic billfish would likely fall into the range of a "data-moderate case." A level of acceptable probability (certainty) must be set to determine the level of confidence that can be placed in the recovery estimates to ensure that stocks are rebuilding within the constraints of the Magnuson-Stevens Act. Therefore, a level of 80 percent confidence in MFMT estimates and at least a 50 percent probability of achieving the B_{target} level (B_{MSY}) in 10 years will be utilized, as suggested in the technical guidelines Collection of statistically robust data is problematic for a wide ranging species, like Atlantic billfish, that are not frequently encountered in fishery sampling designs. In addition, many basic population modeling and life history parameters for Atlantic billfish are either unknown or associated with large variance estimates due to the paucity of data that would provide statistical robustness toward improved precision and accuracy.

3.8 Monitoring, Permitting and Reporting

This subsection does not specifically address mechanisms to reduce fishing mortality. However, permits and other reporting mechanisms are critical components in providing quantitative estimates from all potential sources of mortality for all HMS species. In addition, section 971i(b)(2)(E) of ATCA requires that all monitoring programs must provide "comparable real-time data on commercial and recreational catches and landings through the use of permits, logbooks, landing reports for charter operations and fishing tournaments, and programs to provide reliable reporting of the catch by private anglers." The 1997 ICCAT recommendation also included provisions to improve data collection and monitoring of landings (Appendix B). There is currently no permit required for recreational fishermen to catch Atlantic billfish, nor for charter/headboat operators. Commercial vessels targeting swordfish, tunas and sharks are required to obtain a vessel permit, and report all billfish released (whether alive or dead) in a mandatory logbook system. This action will require consideration of alternatives to enhance monitoring of the recreational fishery to ensure compliance with the 1997 ICCAT recommendation and ATCA provisions. NMFS can authorize activities otherwise prohibited by the FMP and FMP amendment for purposes consistent with the EFP provisions of 50 CFR part 600.745.

Final Action: Require charter/headboat vessels to obtain an annual vessel permit, and submit logbooks, if selected, for all HMS trips.

This action requires all Charter/Headboat operators to obtain a vessel permit in order to fish for HMS, including Atlantic billfish. Permitted vessel owners are responsible for submitting logbook reports, including trip summaries, with catch and effort data and discard information. Logbooks must be completed before offloading of HMS species in the case of one-day trips, or within 48 hours of each day's fishing activity (or before offloading) in the case of multi-day trips. Charter/Headboat operators who already submit the required logbooks under the Northeast Multispecies or Southeast Charterboat Permit programs do not need to submit an HMS logbook at this time. However, all vessels are required to obtain an HMS Charter/Headboat permit.

Ecological Impacts

This final action allows NMFS to monitor recreational landings, and catch and release statistics for Atlantic billfish more accurately, thereby enhancing billfish management and research efforts. This action enables NMFS to monitor recreational landings and catch and release statistics more accurately, thereby enhancing HMS management and research efforts. The total universe of recreational fishermen, and their effort, catch and bycatch (including discards) is unknown at present. Estimates of some of these parameters are currently made using survey instruments, such as the Large Pelagic Survey and the Marine Recreational Fisheries Statistics Survey, as well as voluntary reporting from tournaments. A charter permit system will greatly improve information available to NMFS regarding the recreational HMS fisheries by

providing an accurate measure of participation, effort, catch and bycatch (including discards) from one of its most significant components.

The charter logbooks will collect information similar to that currently collected from the billfish tournament reporting form and the pelagic logbook used for commercial gear: fishing location; gear; measures of effort (number of lines, hours fished, etc.); and number and disposition of catch (discarded dead, discarded alive, tagged, or kept) for each tuna, shark, swordfish, or billfish caught. Information such as the vessel's name and permit number identify the fisherman. Information on the number and size is used to assess total and average weight of the target species being harvested. The effort expended allows estimation of catch per unit effort, an important component of scientific stock assessments. All collected information will be kept confidential. Charter vessels will be required to complete the HMS recreational logbook if selected. NMFS may select, at least initially, all permitted vessels.

Social and Economic Impacts

There will be an economic impact associated with the charter vessel permit and logbook system. The charter vessel owner will be charged a fee for the vessel permit (probably $20 to $40) to cover administrative costs. The logbook will require some of the charterboat captain's time to fill out and send to the appropriate NMFS office. However, public comment at scoping meetings and at HMS and Billfish AP meetings indicated significant support for this alternative among charter boat captains. Many captains already fill out such logbooks and many view faxing their report to NMFS a small burden when weighed against the benefit of supporting more effective HMS management. In addition there will be administrative costs associated with processing permits and logbook information, as well as enforcement costs in ensuring that charter vessels are complying with permit and logbook requirements. In terms of sociological impacts, some charter vessel captains and/or owners may have a negative reaction to a management alternative that requires additional paperwork and regulatory burden on their business operation.

Conclusion

This action will greatly improve NMFS' collection of data from a significant segment of the recreational HMS fishery at a relatively small social and economic cost. Many charter/headboat vessels that fish for HMS already submit logbooks for other fisheries and/or maintain private logbooks to record their fishing activity. The Billfish AP generally supported the use of permit for the charter fleet, and a voluntary logbook system.

Final Action: Voluntary observer coverage of HMS charter/headboat vessels.

This action establishes a voluntary at-sea observer program for HMS Charter/Headboat vessels, including those targeting Atlantic billfish. Current regulations allow NMFS to select any vessel in the Atlantic tuna fisheries to carry an observer. This action expands that practice as a

matter of policy to the HMS Charter/Headboat fishery, with actual levels of implementation subject to the availability of funding as well as the number of fishermen who volunteer to participate.

Ecological Impacts

This action is expected to have beneficial ecological effects for both HMS and other living marine resources that interact with HMS. Observers are deployed on fishing vessels to gather biological information about the composition and character of the total catch, both landed and discarded. This information supplements logbooks, call-in reporting, and dealer reporting and is particularly valuable for collecting information about that portion of the catch that is not brought to shore. This action also supports NMFS' implementation of NS 9 in HMS fisheries because it allows for collection of information about discarded catch. Data collected under this measure will allow NMFS to explore management measures that support requirements of the Magnuson-Stevens Act as well as the objectives of this FMP amendment. These data enhance stock assessments as well as improved management measures.

Social and Economic Effects

This action results in some cost to vessel operators. Vessel operators are required to house and feed observers at the same standard provided to the rest of the crew. However, most of the implementation costs are covered by NMFS, e.g., training and employing observers. A single day of observer coverage costs approximately $650 although that cost is variable depending on the characteristics of the fishery and the observer program.

This complies with the NS 10 requirement to promote safety at sea, because the observer cannot place the vessel above its maximum carriage allowance. If a charter/headboat captain volunteers to participate in the observer program, the vessel's safety gear (e.g., life jackets or personal flotation devices) must be sufficient for everyone aboard, including the observer. The owner of a six-pack (a vessel that can carry six customers) would still be able to carry six passengers-for-hire as well as the observer, as long as the vessel's capacity was not exceeded and the vessel carried the correct amount of lifesaving equipment. The charter/headboat fleet has a disincentive to fish in dangerous or adverse conditions that might deter customers from returning. Because this action is not mandatory, NMFS will not impose the economic burden of placing an observer onboard Charter/Headboats unless the captain volunteers to carry an observer for the purpose of data collection.

Conclusion

This action will provide valuable data on recreational HMS fisheries, including release rates and handling mortality, hook-up rates, life history information, and social and economic data that can only be obtained through the direct observation of fishing activities. The Billfish AP noted in development of the draft FMP amendment that implementation of a mandatory observer program would present problems to charter vessel operators, in terms of impact of the ability to

attract customers on a fishing trip that includes an observer, and the physical space that an observer would occupy, particularly on smaller charter vessels. NMFS received many written and verbal comments confirming the impact of mandatory observers; however, both the Billfish AP and public comment supported the use of an observer program based on voluntary participation. NMFS has considered these comments and has selected a voluntary observer program as the final action. However, the value of any fishery-dependent observations is predicated on a scientifically valid statistical sampling design to ensure proper sampling intensity and frequency that accounts for temporal and geographic variations in fishing effort.

Final Action: Implement billfish tournament notification requirements.

Ecological Impacts

This finalizes actions taken in an interim rule published on March 24, 1998 (63 FR 14030), and extended September 23, 1999 (63 FR 51859; September 29, 1998), by requiring all tournaments involving Atlantic billfish to provide notification of the purpose, dates and location of any tournament involving score keeping or awards for the capture of Atlantic billfish, at least 4 weeks prior to commencement. Atlantic billfish tournaments can be categorized into rodeos, club, and high-profile events (Section 2.1.3), which can last for a weekend to an entire fishing season. A number of comments on the proposed rule indicated that the tournament registration was unnecessary, but public testimony also indicted that the vast majority of billfish are landed during a tournament. Therefore, the tournament notification measure becomes a vital component that will be used to improve monitoring, data collection, and reporting of billfish landings. This action also facilitates compliance with the 1997 ICCAT recommendation to improve monitoring of billfish landings (Appendix B). Previous reporting requirements for tournaments selected for collection of information by the Science and Research Director, as listed under 50 CFR 644.5 (see Section 2.4), will be maintained. However, after receiving comments from the public and the Billfish AP regarding several components of the required information and the form format (Appendix D), NMFS will convene a joint workshop with tournament directors/operators, fishing clubs, and constituent groups (e.g., TBF and CCA), together with the SEFSC to simplify and clarify the reporting process.

The 4-week tournament notification requirement implemented by the interim rule, and subsequently extended, has resulted in an increase in the number of billfish tournaments reporting to the NMFS Southeast Science and Research Director during 1998. The public was informed of the interim notification requirement, along with the increases in Atlantic blue and white marlin minimum sizes with the help of Billfish AP members, the HMS fax network, mailings to known tournaments, state agencies, recreational fishing organizations, and through notices in major recreational fishing magazines.

Economic and Social Impacts

The EA/RIR prepared for the interim rule did not anticipate any negative economic impacts associated with the four-week notification requirement. NMFS has not received any verbal or written comments in response to either the March 27, 1998 interim rule, or the September 29, 1998, extension; however, a small number of commenters on the proposed rule implementing the draft FMP amendment thought the tournament registration was a waste of time and resources. NMFS believes, however, that tournament notification is a key component of a monitoring program that will be utilized to ensure compliance with rebuilding strategies. It is clear that the majority of Atlantic billfish, particularly Atlantic blue and white marlin, are landed during billfish tournaments, therefore without a clear understanding of the total universe of tournaments within the United States, accurate measurements of total mortality can not be achieved. As billfish resources achieve optimum yield levels, the increase in encounter rates will enhance long term net benefits.

Conclusion

This final action enhances the monitoring of the billfish landings by more accurately defining the universe of billfish tournaments. Since recreational anglers are the only source of billfish landings in the United States, this final action is needed to assist in U.S. compliance with the 1997 ICCAT recommendation to improve billfish monitoring of billfish landings.

Final Action: Institute a June 1 to May 31 fishing year for Atlantic billfish.

Ecological Impacts

The June 1 to May 31 fishing year was selected as a final action for the Atlantic billfish FMP to allow NMFS to meet international obligations in a timely manner, while complying with legal rulemaking requirements. A fishing year that starts in June would allow NMFS to comply with rulemaking and ATCA time concerns in implementing new management regulations that address ICCAT recommendations. A June to May fishing year would also be consistent with other HMS fisheries, thereby meeting Objective 5 of FMP amendment. It is important to provide fishery participants with advance notice of any new regulatory changes. Monthly landing rates of Atlantic blue marlin, Atlantic white marlin and west Atlantic sailfish for 1995 to 1997 are shown in Figure 3.8.1. Approximately 73 percent of Atlantic billfish are landed by U.S. recreational anglers during June to September. However, this analysis is based on information generated mainly from the RBS, and therefore does not include landings by private or charter vessels not participating in billfish tournaments.

Economic and Social Impacts

No direct economic or social impacts are expected because this alternative seeks to establish an annual time frame that would provide sufficient time to implement ICCAT recommendations and provide fishery participants with time to prepare for any changes. NMFS received several responses during the comment period for the proposed rule that the June to May fishing year does not reflect the true operational time frame of the recreational billfish fishery, which may impact

the ability of billfish anglers to land fish, and tournaments to plan events near the end of the fishing year. If landing caps for Atlantic blue or white marlin are exceeded, as determined by the most recent tournament and other landings data, it is possible that NMFS would raise the minimum size to avoid exceeding the landing caps. If this were to occur, then spring tournaments could be negatively impacted. However, based on preliminary results of the reductions in 1998 landings as a result of the two 1998 interim measures, it is anticipated that the current size limits (Section 3.4.1) will be sufficient to avoid this possibility. The Atlantic Billfish AP also did not support the June to May fishing year. No additional costs to management or enforcement are anticipated in association with this alternative; however, there will be an increase in costs to improve the level of monitoring of recreational billfish landings.

Conclusion

This is a final action because it will provide consistency with management of other HMS fisheries, complementary with Objective 5 of this FMP amendment, and to meet international obligations in a timely manner.

Final Action: Outreach programs on the methods and benefits of releasing Atlantic billfish alive.

Ecological Impacts

This final action will promote the use of outreach materials and techniques, including workshops, videos, seminars, Internet, and other methods of communication to maximize the effectiveness of live releases of billfish by commercial and recreational fishermen. It is important to note, however, the success of any outreach program is predicated on knowing the entire billfish recreational angler community, which may eventually require implementation of a permit or other registration procedure. A series of industry workshops are also included in the HMS FMP that would incorporate a discussion of how to avoid the bycatch of billfish, and informational exchanges on the handling of billfish to improve post-release survivability. The Billfish AP suggested and helped develop this action, noting that the recreational fishery has done a remarkable job of reducing mortality from pre-1988 levels (year of the Atlantic Billfish FMP) as a result of the promotion of catch and release programs (Figures 3.4.1 and 3.4.2).

Workshops for Atlantic billfish recreational vessel operators and recreational anglers would provide information on proper handling, tagging, measuring and release techniques, as well the effectiveness of various gear configurations (e.g., circle hooks), to enhance post-release survival rates of Atlantic billfish. Outreach programs will also improve reporting in commercial pelagic logbooks and by recreational dockside and telephone surveyors by increasing the awareness of the purpose and methods of NMFS fishery surveys.

Economic and Social Impacts

Attendance at workshops by commercial fishermen, charter vessel operators and recreational anglers would not be mandatory, but would be encouraged and promoted through various

constituent groups (e.g., TBF, CCA, IGFA, RFA), trade publications and federal and state agencies (e.g., NMFS Office of Intergovernmental and Recreational Fisheries, Sea Grant). It is anticipated that workshops would be well received by the public as evidenced by the strong support of this alternative by the Billfish AP. There would be an increase in cost for management to develop, promote and conduct educational workshops, as well as the outreach materials (pamphlets, videos, and other materials). It is difficult to estimate the total cost of an outreach program, but it is possible that costs could be shared among various agencies and constituency groups.

Conclusion

Although it is not possible to quantify the reduction in release mortality or to measure the increase in reporting accuracy as a result of instituting an outreach program including voluntary workshops, this alternative was selected as a final management action because it provides a proactive approach to meeting several objectives of this FMP amendment, specifically Objectives 2, 4 and 11.

Rejected Option: Require vessel permits for all U.S. registered vessels fishing recreationally for Atlantic highly migratory species.

Ecological Impacts

Information collected from permit applications could be used by NMFS to monitor participation in HMS fisheries, including for anglers targeting Atlantic billfish. The vessel permit would also provide additional information to support the development of recreational fishery management policy. For example, a recreational HMS permit database would provide NMFS with a sampling frame that is the basis for fleet size calculations used for catch and effort estimates in fisheries that do not require mandatory reporting. This information would also improve enforcement. Additional information on the vessels participating in HMS recreational fisheries would improve NMFS' ability to analyze impacts of potential management measures on small businesses.

Social and Economic Impacts

A measure to permit HMS anglers would increase the regulatory burden on recreational fishermen, by requiring that they participate in an annual permit process. However, the regulatory burden for both anglers and NMFS could be significantly reduced if HMS permitting were incorporated into the Angling category permit for Atlantic tunas, or expanding the database to include other recreational angler alternatives. Many saltwater fishermen target multiple HMS; for example, some who target billfish also catch other large pelagic species like tuna and sharks. Tuna anglers are already required to hold a recreational permit.

Annual permit issuance/renewal would not have a significant impacts on small businesses. The renewal process would be automated, eliminating paperwork and mailing time for forms. The universe of affected anglers could include the following: the 9,792 vessel owners currently holding Atlantic tunas permits in the Angling (recreational) category and approximately 10,000 billfish anglers (minimum estimate based on the number of billfish tournament anglers from Fisher and Ditton, 1992). The extent of overlap between these three groups is unknown, but is likely to be significant. Thus, the universe of affected vessel owners is likely to be smaller than the sum of the above estimates, as only one permit would be required for participation in any HMS recreational fishery.

Recreational encounters with billfish and swordfish are generally rare, and landings are even less frequent, which makes scientifically-based sampling programs difficult to design and expensive to operate. Requiring tags may be a more feasible option for identifying the universe of recreational HMS fishermen, since anyone who lands a fish would obtain a tag, whether a vessel owner or non-vessel owner. A pilot program implemented through state-federal cooperation has been in place for two years in North Carolina to test the use of tags for monitoring the recreational fishery for bluefin tuna. A universal HMS recreational landing tag program would require further consideration of self-reporting systems, program design and logistics, as well as obtaining public comments on how best to implement such a program. This option is included in the framework provisions; NMFS will continue to consider possibilities for expanding HMS tagging programs in future rulemaking.

Conclusion

This alternative is rejected at this time. NMFS currently requires permits in the recreational Atlantic tunas fishery. In addition, there is currently very little recreational effort directed at swordfish. Finally, NMFS believes that other final actions will adequately address the recreational shark fishery. While NMFS rejects this alternative at this time, it will likely be subject to further consideration by NMFS and the Billfish Advisory Panel in the future.

Rejected Option: Require a landing tag be affixed to all recreationally-landed Atlantic billfish.

Ecological Impacts

The purpose of the landing tag would be to provide a count of every Atlantic billfish landed in the recreational fishery. As discussed in previous alternatives, the 1997 ICCAT recommendation established a limit on landings of Atlantic blue marlin (26.2 mt) and Atlantic white marlin (2.48 mt). However, actual landings by U.S. recreational billfish anglers are currently unknown, and are only partially monitored through billfish tournament reports and the Large Pelagic Survey. This alternative would allow NMFS to more closely monitor the actual number of billfish landed by individual recreational fishermen, as well as provide valuable biological information (size frequencies, sexual maturity, growth, movement patterns, etc.).

Enhancement of landing statistics is also an important component of U.S. obligations to the 1997 ICCAT recommendation to improve billfish monitoring.

The management mechanisms of the billfish landing tag could follow the tarpon program utilized by the State of Florida. Any billfish (Atlantic blue marlin, Atlantic white marlin and west Atlantic sailfish) taken into possession would be required to have a tag inserted and fastened through the lower jaw. The tag must remain with the fish through final processing of the fish (i.e., smoking, filleting, or taxidermy). The number of tags would not be limited and would be readily available to all sectors of the recreational billfish fishery, and would be transferrable as long as reporting requirements are met. NMFS would keep a record of the name, address, and number of tags sent to each billfish angler. Included with the tag would be a self-addressed reporting form that would be mailed to NMFS within seven days after using a tag to retain a fish. The reporting form would include mandatory information (e.g., name, address, species, location of catch, length, weight) and optional data (e.g., sex of fish, manner of fishing). A report would also be submitted to NMFS within seven days of the end of the calendar year accounting for all unused tags. Failure to submit required reports would disqualify an individual from receiving tags from NMFS in the next calendar year. Enforcement of this alternative would require inspection of landed billfish for the presence of a billfish landing tag. The bluefin tag system used in North Carolina provides another possible implementation strategy. The billfish tag system could also be used in future management efforts if it becomes necessary to limit the number of fish landed.

However, the successful implementation of a landing tag system will require further investigation into reporting frequency and accuracy to avoid under-reporting of Atlantic billfish landings. A landing tag would also only provide an estimate of the number of billfish landed, whereas the majority of U.S. recreational anglers now employ a catch-and-release ethic. A landing tag would give no insight into effort expended, number of fish released, or handling mortality, which are important fishery dependent parameters in obtaining an accurate assessment of the status of the stock and the economic and social aspects of the user group.

Economic Impacts

The cost of the tags would be approximately $20 to $30, to cover the administrative costs of tag manufacture, mailing and processing of tag information. Therefore, the short-term economic impacts of this alternative are minimal. Continued inadequate monitoring could result in further reductions in stock levels leading to long-term recreational dissatisfaction and negative net economic benefits.

Social Impacts

It is difficult to determine the social impacts of requiring a billfish tag. Although there was some support for this management measure from the Billfish AP, response received during the

public comment period was generally positive toward landing tags, depending upon the cost of the tag and whether these funds could be utilized to improve management and science of these species. Fisher and Ditton (1992) queried recreational billfish tournament anglers in regards to their support of a "billfish stamp," with a total of 74.6 percent either neutral or supportive of this measure.

Conclusion

A billfish landing tag program can not be implemented until further research is performed on HMS self-reporting systems, program design and logistics, as well as obtaining specific public comment on how best to implement an effective tag program. While NMFS agrees that a tagging program could provide for improved monitoring, a landing tag would only provide information on number of fish that are killed and brought back to shore. The comprehensive HMS monitoring program (permits, logbooks, and observers) is also needed to provide valuable fishery-dependent information, including release rates and handling mortality, hook-up rates (useful in determining relative abundance), life history information and social and economic data. Because a tag system merits further consideration in the future, NMFS has included this alternative in the framework section (see Section 3.11).

Rejected Option: Require all taxidermists to report all mounts of Atlantic billfish.

Ecological Impacts

This alternative would institute a reporting requirement for taxidermists who process Atlantic billfish. This alternative could provide an additional measure of the number and size of billfish landed by recreational anglers, particularly from non-tournament sources. Judge and Farber (1996) made a minimum estimate of west Atlantic sailfish landing along the southeast Florida coast by surveying Florida taxidermists. They reported a total of 1,277 west Atlantic sailfish were killed from 78 responses received in a survey of the 111 taxidermists in southeast Florida. Assuming a 50 pound average weight for each of these fish, the mounted fish translates to approximately 29 mt. The RBS of billfish tournaments encountered only 17 dead west Atlantic sailfish (0.3 mt), while the voluntary Billfish Landings Survey (for non-tournament landings) estimated that 328 west Atlantic sailfish were landed during 1994. Judge and Farber also pointed out that the MRFSS estimated landings of 8,365 west Atlantic sailfish from the east coast of Florida during 1994. These estimates provided very different estimates in west Atlantic sailfish landings. It is also likely that a portion of the west Atlantic sailfish voluntarily reported by the taxidermists were included in other surveys of billfish landings, confounding the usefulness of the estimates generated from the taxidermist survey.

Economic and Social Impacts

Taxidermists would incur an increased economic burden in terms of time to fill out reports and costs associated with mailing responses. There will also be an increased cost to management in developing, tracking and processing reports. Enforcement costs will also increase in ensuring

that reports are submitted on a timely basis. It is likely that taxidermist will regard reporting of Atlantic billfish mounts as intrusive and disruptive to business operations, and may be duplicative of other fishery surveys.

Conclusion

Use of taxidermist reports would likely be most useful for estimating non-tournament landings of west Atlantic sailfish. However, this alternative was not selected because of the likelihood of overlap with other existing surveys, the uncertainty of the applicability of estimates to actual landings, and the social and economic burden associated with this alternative without a clear benefit to enhancing monitoring capabilities. The 1997 ICCAT recommendation establishing landing limits for Atlantic blue and white marlin necessitate more accurate measures of landings that could be generated with this rejected management alternative.

Rejected Option: No Action Alternative (Status Quo).

Ecological Impacts

The 1997 ICCAT recommendation for billfish requires a reduction of at least 25 percent in landings from 1996, to be accomplished by the end of 1999. The recommendation also called for an improvement in data collection and work to improve current monitoring and reporting procedures. The status quo alternative would provide no additional monitoring or improvement in data collection from the recreational components of the Atlantic billfish fishery.

Economic Impacts

The long-term impacts of a inadequate monitoring strategy of Atlantic billfish catch and landing levels could inhibit the recovery process, leading to decreased recreational angler participation and associated reductions in revenue.

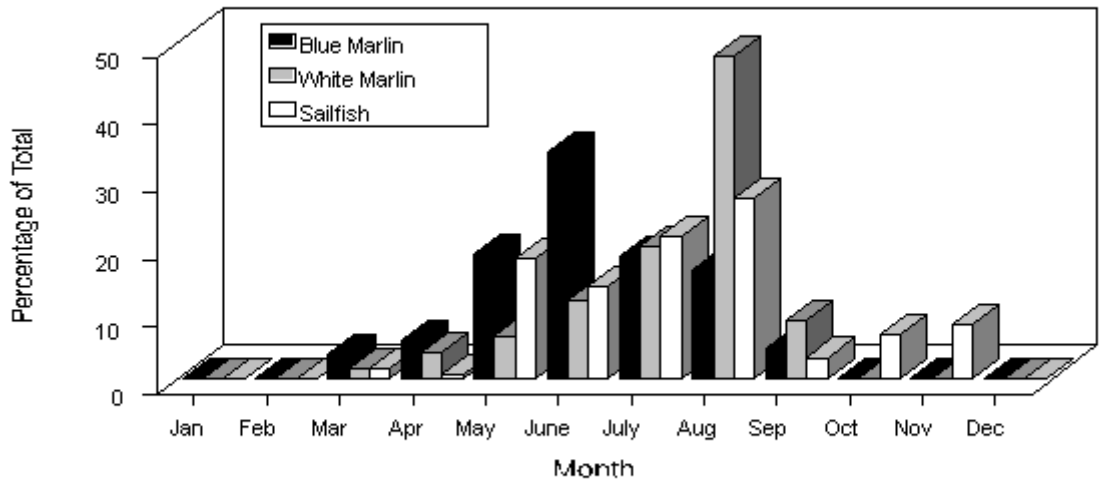
Social Impacts

Unless monitoring is improved to provide quality data on overfished species, it will be difficult to implement successful rebuilding programs. Billfish anglers will likely experience a reduction in recreational satisfaction as encounters with target species become less frequent.

Conclusion

Taking no action would not provide any additional information to monitor U.S. Atlantic billfish landings, which would be inconsistent with the 1997 ICCAT recommendation. Therefore, this alternative was rejected for the reasons stated above.

Figure 3.8.1. Monthly distribution of Atlantic blue marlin, Atlantic white marlin and west Atlantic sailfish as a percentage of the total number landed during 1995 to 1997.



3.9 Extension of the Management Unit and Management Authority

The current definition of the management unit for Atlantic blue marlin and white marlin is the waters of the North Atlantic Ocean (including the Gulf of Mexico and the Caribbean Sea) north of 5° N. However, SCRS has concluded that a single management unit including the entire Atlantic Ocean, is more appropriate for Atlantic blue and white marlin. In addition, Atlantic billfish regulations implemented under the authority of the Magnuson Act, restricted fishing-related activities (possession and retention, size limits, gear limitations and incidental catch restrictions) within the jurisdictional limits of the U.S. EEZ. U.S.-flagged commercial and recreational vessels operating exclusively outside the U.S. EEZ and U.S. citizens fishing in foreign waters are not affected by these restrictions, although the sale, purchase or barter of Atlantic billfish harvested from the management unit (i.e., for blue and white marlin, the Atlantic Ocean north of 5°N) is prohibited. Therefore, current billfish regulations will be much more effective if they are extended under the authority of ATCA to cover the operational area of U.S.-flagged vessels and U.S. citizens recreational fishing activity in the Atlantic Ocean.

Final Action: Extend the management unit for Atlantic Blue Marlin and Atlantic White Marlin to the entire Atlantic Ocean and implement regulatory actions for Atlantic blue and white marlin under both the Magnuson-Stevens Act and ATCA.

The current Atlantic billfish regulations (50 CFR part 644) were implemented under the authority of the Magnuson Act, which limits the impact of these management actions, with some exceptions, to the jurisdiction of the U.S. EEZ. Current prohibitions and management measures for Atlantic billfish are limited to U.S.-flagged vessels operating shoreward of the outer boundary of the U.S. EEZ (e.g., size limits, possession by commercial vessel). The one exception to the limited scope of the current regulations is the prohibition of the purchase, barter, trade, sale, or offer for sale of an Atlantic billfish harvested from its management unit (i.e., for blue and white marlin - the Atlantic Ocean north of 5°N; west Atlantic sailfish - waters of the Atlantic Ocean west of 30°W longitude, and for longbill spearfish - the Atlantic Ocean). However, Atlantic billfish are highly migratory, and are found throughout much of the Atlantic Ocean. The Atlantic Tunas Convention Act provides the Secretary with the authority to implement ICCAT recommendations. Regulations implemented under ATCA, unlike the Magnuson-Stevens Act, would impact U.S.-flagged vessels and U.S. citizens, regardless of where they are operating in the Atlantic Ocean.

Ecological Impacts

The proposed extension of the management unit for Atlantic blue marlin and Atlantic white marlin to the entire Atlantic Ocean reflects ICCAT's recent support of the total Atlantic stock hypothesis for these species (SCRS, 1997). Stock hypotheses for blue and white marlin have included a total Atlantic hypothesis, and a separate north and south Atlantic hypothesis. A latitudinal boundary of 5°N has historically been used to separate north and south management units. The two stock hypotheses were reviewed at the Third ICCAT Billfish Workshop, held in Miami, Florida during July, 1996.

Support of a single Atlantic stock of blue marlin was based on a suite of biological studies. The pattern of blue marlin catches, by quarter (1950 to 1994) in the Atlantic Ocean reveals a continuous distribution of individuals across the 5°N line used to delineate north and south Atlantic blue marlin stocks (SCRS, 1998). No morphometric differences have been noted between blue marlin from the north and south Atlantic. Tag recoveries of 131 Atlantic blue marlin from NMFS tags (Jones and Prince, 1996) and 29 from The Billfish Foundation tags (Peel *et al*., 1996) indicate both trans-Atlantic (six fish) and trans-equatorial (two fish) movement. The population structure of blue marlin in the Atlantic Ocean was investigated using restriction fragment length polymorphism (RFLP) analysis of mtDNA (Graves and McDowell, 1996). Genetic variation was compared among samples to identify spatial (geographic) and temporal (years) variations. Although analyses of 235 marlin from the United States, Caribbean and Brazilian waters revealed relatively high levels of genetic variation (in comparison to white marlin and sailfish), no significant heterogeneity was identified between samples of blue marlin from the north and south Atlantic. In addition, levels of intraspecific genetic divergence among the Atlantic samples was much lower than those noted between Atlantic and Pacific blue marlin.

Biological information available for Atlantic white marlin evaluated by the 1996 workshop was also consistent with a single Atlantic stock. No morphometric differences have been noted between white marlin from the north and south Atlantic. White marlin catches in the Atlantic Ocean from 1950 to 1994, by quarter, show a continuous distribution of individuals across the 5°N previously used to delineate north and south Atlantic white marlin stocks. Analysis of white marlin population structure using RFLP analysis of mtDNA (Graves and McDowell, 1996) revealed that distribution of mtDNA haplotypes among collections of white marlin from throughout the Atlantic Ocean were relatively homogenous which is consistent with a single genetic stock. Tag returns from NMFS tags (N=512; Jones and Prince, 1996) and from The Billfish Foundation tags (N=40; Peel *et al*., 1996) indicate extensive northerly and southerly movements. These include movements from fish tagged off the mid-Atlantic U.S. coast and recovered off the northeast coast of Brazil (including 3 below 5°N), as well as trans-Atlantic movement; however, no trans-equatorial movements have been verified.

Under current Magnuson-Stevens Act, Atlantic billfish caught outside the EEZ can legally be possessed and retained by U.S. commercial vessels, and can be sold outside the U.S. EEZ (but not in the United States) if the fish were taken south of 5°N (i.e., outside of the definition of the management unit), and as long as the vessel operates exclusively outside U.S. waters. The recent expansion of the U.S. swordfish and tuna pelagic longline fleet into the South Atlantic increases the potential for commercial harvest of Atlantic blue and white marlin. A similar situation exists for sailfish that are caught by commercial vessels operating east of 30°W. In addition, recreational anglers who use their U.S. flagged vessels in waters outside the U.S. EEZ (e.g., Bahamas, Costa Rica, British Virgin Islands and other Caribbean territories) are not bound by U.S. minimum size limitations.

Enforcement of the "no-sale" provision is very difficult, primarily because the "Certificate of Eligibility for Billfishes" is the only proof that an enforcement officer has that a billfish found in commerce is a billfish harvested from the Pacific Ocean and not from its management unit or the

Atlantic Ocean. The certificate creates a paper trail that lists the names of persons who have handled the billfish on its route from the ocean to the seafood consumer. These certificates are written documents that may be falsified, but they are possibly the only tool available to document the origin of a piece of billfish meat.

Extension of the management unit for Atlantic blue marlin and Atlantic white marlin to the entire Atlantic Ocean would be consistent with the biology of these species, as outlined above. Implementation of management measures under both the Magnuson-Stevens Act and ATCA would improve NMFS's ability to control Atlantic blue and white marlin fishing mortality in U.S. fisheries throughout the biological range of these overfished stocks.

Economic Impacts

Extension of Atlantic marlin regulations under ATCA may result in reduced participation of U.S.-flagged vessels (recreational) outside the U.S. EEZ, particularly billfish tournaments (e.g., Bahamas), if foreign countries have less restrictive management measures than those used in the United States (e.g., smaller minimum size limits). Private U.S. citizens would also be impacted by expansion of management authority under ATCA (Section 971e(a)(2)), by being required to follow all U.S. regulations (e.g., minimum size limits) that apply to Atlantic blue and white marlin, regardless of where fishing in the Atlantic Ocean, and whether or not the fishing boat was a registered U.S. vessel or under foreign flag. Although the harvest and sale of billfish by U.S.-flagged commercial vessels has not been documented, it is possible that if any vessels are currently selling billfish harvested in the south Atlantic in foreign ports, they would experience an economic loss if the preferred alternative is implemented. The impact of the loss would be likely be minimal, since Atlantic marlin generally consist of less than 1 percent, by species, of the total annual pelagic longline catch. U.S.-flagged commercial vessels fishing under contract to foreign nations that require landing of all fish (including Atlantic billfish), would require evaluation by NOAA GCEL to determine ATCA conflicts. Therefore, an accurate assessment of the economic impact of this alternative is confounded because the number of U.S.-flagged vessels that would be impacted by restricting billfish angling activities in foreign waters is unknown.

The enforcement and management costs for this alternative are difficult to quantify, but should be minimal. There should be no additional costs required to enforce billfish regulations impacting U.S. commercial pelagic longline vessels operating in the Atlantic Ocean since the same vessels potentially catching billfish are also operating under other Atlantic-wide fishing prohibitions (North and South Atlantic swordfish) that require enforcement and monitoring. There may be some additional costs associated with enforcing minimum sizes for recreational operations, particularly for U.S.-flagged vessels fishing beyond the U.S. EEZ. Management costs would generally be limited to educational activities to notify the recreational billfish angling community and commercial HMS fishing entities of new regulatory constraints. There are no additional safety issues resulting from this final action.

Social Impacts

Consistent regulations throughout the range of the species may initially receive a negative reaction, particularly for anglers using their U.S.-flagged vessels in foreign waters, where they would have to adhere to potentially more restrictive management measures than those of local governments. However, as stocks rebuild, recreational angler satisfaction should increase as billfish encounters become relatively more frequent.

Conclusion

The cumulative impact of extending the management unit definition of Atlantic blue marlin and Atlantic white marlin to the entire Atlantic, and implementing Atlantic blue and white marlin regulations under both the Magnuson-Stevens Act and ATCA, will provide for a precautionary approach to controlling Atlantic-wide billfish fishery-related (commercial and recreational) mortalities. The expansion of the management unit is consistent with National Standard 2 which requires that "Conservation and management measures shall be based upon the best scientific information available." Further, expansion of regulatory authority is supported by National Standard 3 that requires "To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination." Current Atlantic blue and white marlin regulations will be much more effective if they are extended to cover the operational area of U.S.-flagged vessels, throughout the biological range of the Atlantic billfish species. Therefore, this alternative is selected as a final management action.

Rejected Option: No Action Alternative (Status Quo).

Ecological Impacts

The status quo alternative would limit the impact of regulations within the geographical constraints of the Magnuson-Stevens Act, as well as maintain the current definitions of the management units for Atlantic blue marlin and Atlantic white marlin (i.e., north of 5ºN). The status quo will not allow for reductions in fishing mortalities attributable to U.S.-flagged recreational and commercial vessels operating outside the U.S. EEZ or management units of blue and white marlin. Continued management under sole authority of the Magnuson-Stevens Act could inhibit rebuilding efforts for overfished Atlantic billfish resources.

Economic and Social Impacts

Given the biological status of Atlantic billfishes and the Atlantic-wide distribution of Atlantic blue marlin and Atlantic white marlin, taking no action could lead to further decline in stock size. This would result in reduced net benefits in the long-term. The status quo would not allow for consistent management of these species throughout the biological and functional range of billfish fisheries. The long-term social impacts of a declining stock may result in switching of recreational anglers to other species (e.g., dolphin, wahoo, tunas).

Conclusion

Atlantic billfish resources are migratory species that require management throughout their range for rebuilding efforts to be effective. The alternative is rejected based on the wider management scope required to effectively manage overfished highly migratory species resources.

3.10 Safety of Human Life At Sea

National Standard 10 of the Magnuson-Stevens Act emphasizes the requirement that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea. Fishing, whether for recreation or for commercial application, is an inherently dangerous activity where not all hazardous situations can be foreseen or avoided. Fishermen are continuously exposed to high risk during transit and while fishing. Most Atlantic billfish angling occurs in deep oceanic waters that can be far from shore. Professional fishermen identified inexperience, inattention, and fatigue as the most likely contributors to safety problems (NRC, 1991). Many fishermen fish in multiple geographical areas throughout the year. This interregional activity greatly increases the local knowledge needed by vessel captains to operate safely. Fishery management measures may constrain fishermen to fish under conditions that they would otherwise prefer to avoid. This FMP amendment was reviewed by the Atlantic Billfish AP and HMS Consulting Parties, including the U.S. Coast Guard, during development of alternatives and regulations, to ensure that fishery managers recognize any impact on the safety of human life at sea and minimize or mitigate those impacts where practicable.

As domestic management measures become more restrictive and recreational fishermen are faced with escalating costs and a near-stable or declining resource base, fishermen are sometimes forced to minimize maintenance, which has implications for safety. Cutbacks may mean less attention to preventive maintenance of fishing gear or to the vessel itself. Because many vessels that participate in billfish fishing travel great distances from shore, selection of management measures must take into consideration economic losses and the potential effects on the safety of human life at sea. Some form of insurance is needed by fishing vessel owners to protect themselves against loss or damage to their vessels and potential financial liabilities that can result from injuries or damage to others, including their own crew members. Recognizing these economic considerations should be a major motivation to address vessel safety issues (NRC, 1991).

The following safety considerations have been considered in evaluating the management measures outlined in this FMP amendment:

Operating environment: An FMP should try to avoid creating situations that result in vessels going out farther, fishing longer, or fishing in weather worse than they generally would have in the absence of management measures.

Gear and vessel loading: An FMP should consider the safety and stability of fishing vessels when requiring specific gear or requiring the removal of gear from the water.

Limited season and area: An FMP should attempt to mitigate the effects caused by "derby" fisheries, and avoid them in new management regimes.

The primary responsibility for safety resides with the vessel operator in both recreational and commercial fisheries. NMFS does not have information regarding losses of recreational vessels. In 1996, 31 deaths and 69 vessel losses were documented by the U.S. Coast Guard resulting from fishing trips in the Atlantic Ocean and Gulf of Mexico (USCG, 1996). Casualty data from 1997 were specific to the type of vessel and illustrate the relatively low rate of casualties in the Atlantic longline fishery. In 1997, there were two Atlantic longline vessels that sank and were reported by the USCG. One vessel sank as a result of a collision, but the three persons on board did not use survival craft. The other vessel caught fire which was attributed to a battery spark and the four crew members were picked up in a life raft. One vessel was reported as a loss and the other vessel was later salvaged (USCG, 1997). In general, collisions stand out as a safety problem on the Gulf Coast while material failure incidents are high along the North Atlantic coast (NRC, 1991). Weather has been cited as a particular problem for the isolated distant water fleet. HMS fishing vessels tend to have less machinery on board than the larger processing vessels or trawling vessels.

Accidents that can occur on recreational vessels occur when handling (landing or releasing) hooked billfish or large tunas or can occur as a result of fatigue (handling large numbers of fish). Releasing a large fish is difficult in rough seas and can result in personal injury, especially back injuries. NMFS advises vessel operators to avoid unsafe conditions, have regular U.S. Coast Guard inspections, purchase and maintain safety equipment, educate and train crew members or paying customers, and be prepared for emergencies.

3.10.1 Fishery Access and Weather-Related Vessel Safety

The following fishery management regulations have raised concerns by the fishermen in that they directly or indirectly pose a hazard to the crew or vessel safety under adverse weather or ocean conditions. Such measures particularly may affect, or have the potential to affect, the operation of fishing vessels and safety risks taken by vessel operators under adverse weather or ocean conditions.

Retention Limits

Safety Concern: Injury to fishermen while attempting to measure and, if necessary, discard Atlantic billfish, to comply with minimum size requirements, or possession restrictions.

Mitigating Factors: Handling large, feisty fish is inherently a risky task. Cuts and abrasions occur, as do more serious accidents related to entanglement of fishermen or their hands in fishing gear. Billfish must be released by all commercial vessels and the minimum size is such that billfish pose a safety risk for recreational fisherman as well. NMFS will include a discussion on the proper handling of released fish as part of the outreach program established in this FMP amendment. NMFS intends for experienced fishermen to share their experiences with others in order to mitigate any safety concerns for the fishermen and the fish.

3.10.2 Procedures for Consideration of Management Adjustments

The views of fishery participants and other concerned citizens are obtained by the NMFS through Atlantic Billfish AP and HMS AP meetings as well as the ICCAT Advisory Committee, public hearings, public meetings, and constituent input through letters and phone calls. All HMS Consulting Parties are consulted during the public comment period of rulemakings, including the Department of State, the U.S. Coast Guard, the ICCAT Commissioners, fishery management councils, and other entities listed in the proposed HMS Process (NMFS, 1997b). These various management partnerships give NMFS an opportunity to consider the implications of proposed management measures, including their safety implications. Procedures to adjust the management measures are described in section 3.11. To date, safety issues have been considered by the both the Atlantic Billfish and HMS APs. Under the Statement of Operating Procedures for the AP, NMFS may establish a sub-panel. For some proposed management measures, this sub-panel would be established to monitor, evaluate, and report on the effect of management measures on vessel or crew safety, particularly under adverse weather or ocean conditions.

3.11 Ongoing Management

3.11.1 An Introduction to FMP amendments and Frameworks

The activities involved in continuing fishery management include monitoring, evaluation, adjustment, and revision. There are two primary methods that can be used to change management measures included in an FMP: FMP amendment and framework regulatory adjustment. As described in Chapter 1, NMFS will follow the HMS process for all FMP amendments, including the present document. FMP amendments are performed when the proposed action is significant (i.e., will have a significant impact on the environment).

Unlike FMP amendments, the framework regulatory adjustment procedure provides for timely annual changes to the management measures in the regulations in response to new information about the fishery. Framework adjustment lends flexibility and efficiency to the regulatory process by allowing NMFS to make time-critical changes in the regulations, such as in-season adjustments, without engaging in the lengthy and cumbersome process of amending the FMP. Framework adjustment is not intended to circumvent the FMP amendment process that must take place when circumstances in the fishery change substantially or when a different management philosophy or objectives are adopted, triggering significant changes in the management system. Rather, framework adjustment is intended to make it possible to manage fisheries and meet the objectives of the FMP more responsively under conditions requiring timely management actions. As with an FMP amendment, framework adjustments must go through extensive public and analytical review, including development and review by the APs. This includes a proposed rule, a public comment period, at least one public hearing, and a final rule. AP meetings will be held for a rulemaking if the agency deems it necessary for purposes of consultations or AP review.

3.11.2 Stock Assessment and Fishery Evaluation Report

NS 2 of the Magnuson-Stevens Act requires that NMFS take into account the best scientific information available in developing FMPs and implementing regulations. The guidelines for implementation of NS 2 require preparation of an annual Stock Assessment and Fishery Evaluation (SAFE) report. These guidelines are below.

(e) (1) The SAFE report is a document or set of documents that provides [the Secretary] with a summary of information concerning the most recent biological condition of stocks and the marine ecosystems in the [management unit] and the social and economic condition of the recreational and commercial fishing interests, fishing communities, and the fish processing industries. It summarizes, on a periodic basis, the best available scientific information concerning the past, present, and possible future condition of the stocks, marine ecosystems, and fisheries being managed under Federal regulation.

(i) The Secretary has the responsibility to assure that a SAFE report or similar document is prepared, reviewed annually, and changed as necessary for each FMP. The Secretary or Councils

may utilize any combination of talent from Council, state, Federal, university, or other sources to acquire and analyze data and produce the SAFE report.

(ii) The SAFE report provides information to the Councils for determining annual harvest levels from each stock, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, and assessing the relative success of existing state and Federal fishery management programs. Information on bycatch and safety for each fishery should also be summarized. In addition, the SAFE report may be used to update or expand previous environmental and regulatory impact documents, and ecosystem and habitat descriptions.

(iii) Each SAFE report must be scientifically based, and cite data sources and interpretations.

(2) Each SAFE report should contain information on which to base harvest specifications.

(3) Each SAFE report should contain a description of the maximum fishing mortality threshold and the minimum stock size threshold for each stock or stock complex, along with information by which the [Secretary] may determine:

(i) Whether overfishing is occurring with respect to any stock or stock complex, whether any stock or stock complex is overfished, whether the rate or level of fishing mortality applied to any stock or stock complex is approaching the maximum fishing mortality threshold, and whether the size of any stock or stock complex is approaching the minimum stock size threshold.

(ii) Any management measures necessary to provide for rebuilding an overfished stock or stock complex (if any) to a level consistent with producing the maximum sustainable yield in such fishery.

(4) Each SAFE report may contain additional economic, social, community, essential fish habitat, and ecological information pertinent to the success of management or the achievement of objectives of each FMP.

Each year in January or February, NMFS will publish one SAFE report for billfish and each species in the HMS FMP. The SAFE report will follow the guidelines specified in NS 2 and will be used by NMFS to develop and evaluate regulatory adjustments under the framework procedure or the FMP amendment process. This information will provide the basis for determining annual harvest levels from each stock, documenting significant trends or changes in the resource and fishery over time, and assessing the relative success of existing state and Federal fishery management programs. In addition, the SAFE report will be used to update or expand previous environmental and regulatory impact documents, and ecosystem and habitat descriptions, including EFH.

3.11.3 Advisory Panel and Continuing Fishery Management

The Assistant Administrator is responsible for implementing, monitoring, and amending the HMS FMP and its implementing regulations. As required by section 302(g)(4) of the Magnuson-Stevens Act, NMFS established an Atlantic Billfish AP and an HMS AP to assist in the collection and evaluation of information relevant to the development of the Atlantic billfish FMP amendment and HMS FMP and any subsequent amendments. Decisions and recommendations of the AP are advisory in nature. Following publication of the annual SAFE report, NMFS will convene the AP to evaluate management measures relative to the objectives of the FMP. The Advisory Panel will meet quarterly with meetings set up early in the year. NMFS may also

convene meetings of the AP at other appropriate times throughout the year. If NMFS, with the assistance of the AP, concludes that the FMP must be amended to achieve the objectives of the FMP, NMFS will follow the HMS process for amending an FMP. Alternatively, NMFS may determine that it is not necessary to amend the FMP but that a regulatory amendment is appropriate under framework provisions of the FMP to achieve the objectives of the FMP.

3.11.4 Procedure for Adjusting the Management Measures

Based on the annual SAFE report, deliberations of the AP, and other relevant factors, NMFS will determine whether any adjustments to management measures contained within the FMP are necessary in order to achieve the management objectives and rebuilding programs stated in this FMP. Adjustments made by framework to meet the objectives of the FMP may include changes in:

- alter maximum sustainable yield and optimum yield based on stock assessment updates through the SAFE process;
- recreational retention limits that can be adjusted seasonally or annually;
- minimum size limits;
- permitting and reporting requirements;
- monitoring and tracking programs (e.g., landing tag);
- gear restrictions;
- landing limits; and
- actions to implement ICCAT recommendations, if appropriate.

The goal is to implement regulatory changes by the start of the new fishing year or as soon after a new stock assessment or updated SAFE report as possible. If NMFS determines that adjusting the management measures is necessary to achieve the objectives of the FMP amendment and its rebuilding programs, it will prepare a regulatory package including a discussion of the need for action; the proposed adjustments to the management measures; analyses as required by applicable law of the social, economic, environmental, and biological impacts of the proposed measures; and the proposed rule. The comment period on the proposed rule will generally be 45 days, but may be extended or reduced as appropriate. NMFS will hold at least one public hearing and AP meeting on each proposed rule. The Atlantic Billfish AP and HMS FMP will jointly discuss issues involving Atlantic billfish bycatch from commercial fishing operations, as regulated in the HMS FMP.

After reviewing public comments and additional information or data that may be available, NMFS will, if appropriate, make final determinations regarding consistency of the proposed conservation and management measures with the objectives of the FMP, the National Standards, and other applicable law. Within 30 days of the close of the public comment period on the proposed rule, NMFS will publish a final rule in the Federal Register.

If circumstances warrant during the year (e.g., changes in regulations in related fisheries), NMFS may take regulatory action independent of the SAFE report. NMFS will subsequently follow the procedures outlined above.

In order to improve the information upon which EFH delineations are based, NMFS may change or update the EFH Provisions through a framework process analogous to the regulatory framework. The modified process is required because the EFH Provisions have no accompanying regulations that can be modified under the standard framework procedure. Under the analogous process, NMFS will publish a notice of the proposed changes in the Federal Register. After a minimum of thirty days for public comment on the proposed changes, and due consideration of the public input, NMFS will publish, in the Federal Register, a notice of the changes to EFH as approved. Components of the EFH Provisions that may be changed under this framework procedure include the life history information of managed species, identification and description of EFH, identification of threats to EFH and appropriate conservation measures, assessment of fishing impacts on EFH, identification of EFH-Habitat Areas of Particular Concern (HAPCs) and any other subjects that contain no regulatory action.

References for Chapter 3

Alverson, D.L, M.H. Freeburg, S.A Murawski, and J.G. Pope. 1994. A global assessment of fisheries bycatch and discards. FAO Fish. Technical Paper No. 339. 233pp.

Au, D.W. *In press*. Protecting the Reproductive Value of Swordfish and other Billfishes. Southwest Fishery Science Center, La Jolla, California 92038.

Belle, S. 1997. Mortalities and healing processes associated with hook and line caught juvenile bluefin tuna from two different handling methods; control (untagged) and dart tagging. Final Report, NOAA Grant No. NA27FL0199. 24pp.

Berkeley, S.A and R.E. Edwards. 1997. Reduction of bluefin tuna and undersize swordfish bycatch in Atlantic longline fisheries. Final Report, NOAA Grant No. NA57FD0031. 9 pp + Figures, Tables and Appendices.

Cramer, J. 1996 Pelagic longline bycatch. Sustainable Fisheries Division Contribution SFD-97/98-06. 61 pp.

Cramer, J., A. Bertolino, and G.P. Scott. 1997. Estimates of Recent Shark Bycatch by U.S. Vessels Fishing for Atlantic Tuna and Tuna-like Species. 1998 SEW Document SB-IV-22

Cramer and Adams 1998. Large pelagic logbook newsletter 1996. NOAA Technical Memorandum. NMFS - SEFSC - 407, 61pp.

Ditton, R.B. and D.J. Clark. 1994. Characteristics, Attitudes, Catch and Release Behavior, and Expenditures of Billfish Tournament Anglers in Puerto Rico. Report prepared for The Billfish Foundation, Ft. Lauderdale, FL. 27pp.

Edwards, R.E, A.P McAllister and B.D. Fortune. 1989. Billfish mortality and survivability. Technical Report. No. 8, SAFMC Contribution No. 13. 29 pp. + Appendices.

Fedler, A.J. and R.B. Ditton. 1990. A Social and Economic Research Agenda in Support of Billfish Conservation *In* Planning the Future of Billfishes: Research and Management in the 90's and Beyond, Part 2. Marine Recreational Fisheries 13. R.H. Stroud (ed.), National Coalition for Marine Conservation, Savannah, GA, pp 263-267.

Fisher, M. R. and R. B. Ditton. 1990. Characteristics, Behaviors, Attitudes, Expenditures, Harvest, and Management Preferences of Billfish Tournament Anglers. Report prepared for The Billfish Foundation, Fort Lauderdale, FL. 43pp.

Fisher, M.R. And R.B. Ditton. 1992. Characteristics of Billfish Anglers in the U.S. Atlantic Ocean. Marine Fisheries Review 54(1):1-6.

Goodyear, C.P. 1998. The Minimum Stock Size Threshold for Atlantic Blue Marlin. Report for The Billfish Foundation. 7 pp.

Graves, J.E. and J.R. McDowell. 1996. Population genetic structure of Atlantic istiophorid billfishes. SCRS/96/107.

Jolley, J.W. Jr, and E.W. Irby, Jr. 1979. Survival of tagged and released Atlantic sailfish (*Istiophorus platypterus*:Istiophoridae) determined with acoustical telemetry. Bull. Mar. Sci. 29(2): 155-169.

Jones, C.D. and E.D. Prince. 1996. The cooperative tagging center mark-recapture database for *Istiophoridae* (1954-1995), with an analysis of the west Atlantic ICCAT billfish tagging program. SCRS/96/96.

Jones, C.D, M. Ortiz, M.T. Judge, and E.D. Prince. 1997. A review of the cooperative tagging center release and recapture activities for highly migratory species: 1954 to present. SCRS/97/70 23 pp.

Judge, M.T. and M.I. Farber. 1996. Report on the 1994 Florida taxidermist voluntary survey from Cape Canaveral to Key West. SCRS/96/102.

Nakamura, I. 1985. FAO Species Catalogue. Vol. 5. Billfishes of the world. An annotated and illustrated catalogue of marlins, sailfishes, spearfishes and swordfishes known to date. FAO Fish Synop., (125) Vol. 5:65 p.

NMFS. 1997. 1994/1995 Report of the Southeast Fisheries Science Center Billfish Program. NOAA Technical Memorandum NMFS-SEFSC-38. 15 pp.

NMFS 1997b. Draft Administrative Process for the Management of Highly Migratory Species.

NMFS. 1998. Managing the Nation's Bycatch: Programs, Activities, and Recommendations for the National Marine Fisheries Service. June 1998.

National Research Council (NRC). 1991. Fishing Vessel Safety: Blueprint for a national program. Washington, D.C., National Academy Press. 260 p.

Restrepo, V.R., G.G. Thompson, P.M. Mace, W.L. Gabriel, L.L. Low, A.D. MacCall, R.D. Methot, J.E. Powers, B.L. Taylor, P.R. Wade, and J.F. Witzig. 1998. Technical Guidance On the Use of Precautionary Approaches to Implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-31. July 17, 1998.

Peel, E.M., J. Rice, M. Ortiz, and C.D. Jones. 1996. A tagging summary of The Billfish Foundations tagging program (1990-1996). SCRS/96/103.

Prince, E.. 1998. SEFSC, Miami, FL. Personal communication.

Scott, E.L., E.D. Prince, and C.D. Goodyear. 1990. History of the cooperative game fish tagging program in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea, 1954-1987. AFS Symposium 7:841-853.

Skomal, G. 1998. Massachusetts Division of Marine Fisheries, Vineyard Haven, MA, personal communication.

Skomal, G.B. and B.C. Chase (1996). Preliminary result son the physiological effects of catch and release of bluefin tuna (Thunnus thynnus) caught off Cape Hatteras, North carolina, SCRS/96/126. 9 pp.

SCRS. 1996. Report of the Third ICCAT Billfish Workshop. International Commission for the Conservation of Atlantic Tunas. Miami, Florida, U.S.A., July 11-20, 1996. COM-SCRS/96/19

SCRS. 1997. Report of the Standing Committee on Research and Statistics (SCRS). International Commission for the Conservation of Atlantic Tunas, Madrid, Spain, October 20-24, 1997. COM/97/17

SCRS 1998. Report of the Standing Committee on Research and Statistics (SCRS). International Commission for the Conservation of Atlantic Tunas. Madrid, October 19-November 23, 1998. COM/98/16

U.S. Coast Guard. 1996. Commercial Fishing Vessel Deaths and Losses.

U.S. Coast Guard. 1997. Commercial Fishing Industry Casualty Data.